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REPORT

Final Design Report

Bern Metal/Universal Sites
(Site No. 915135)
Buffalo, New York

October 1998

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

TECHNICAL REPORT

Final Design Report

Name: Andrew N. Johnson, P.E.
Professional Engineer No. 058343

Bern Metal/Universal Sites
(Site No. 915135)
Buffalo, New York

October 1998

BBL
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Table of Contents

1. Introduction

1.1 General

This Pre-Final Design Report has been prepared by Blasland, Bouck & Lee, Inc. (BBL) for the Bern Metal/Universal Iron & Metal Site (Site No. 915135) on behalf of the Bern Metal/Universal Metal Site (Site) Respondents. This report outlines the remedial design, operation, and monitoring required for the implementation of the remedial action for the Site, and was prepared in accordance with the following documents:

- March 1996 Record of Decision (ROD), issued by New York State Department of Environmental Conservation (NYSDEC);
- Administrative Order on Consent (AOC) (Index No. B9-0371-05) between NYSDEC and the Bern Metal/Universal Metal Site Respondents;
- Field Sampling Plan (FSP), prepared by BBL, and submitted to NYSDEC in January 1998; and
- Remedial Design Work Plan (RDWP), prepared by BBL, and submitted to NYSDEC in January 1988.

The RDWP for the Site described the activities associated with the remedial design of the selected remedy, and included the following components:

- Basis of Design;
- Preliminary Design; and
- Description of Pre-Final and Final Design Report.

In support of the RDWP, a pre-design investigation was performed at the Site to further delineate the extent of lead-impacted soil located on adjacent properties that exceed the clean-up criteria established in the ROD. The pre-design investigation was performed in accordance with the FSP. The pre-design investigation included the collection of surface and subsurface soil samples from the Universal property and properties adjacent to the Site, and analysis of collected samples for total lead. The FSP was implemented in April 1998 and results are presented in this report.

1.2 Objectives

The objective of this report is to present a system design that will meet the requirements of the selected remedy for the Site established in the ROD.

The remedial objectives selected for the Site are:

- Eliminate the potential for direct human contact with the contaminated soils and groundwater on site;
- Eliminate off-site migration of contaminated soils and surface water via storm-water runoff;
- Minimize to the extent practicable, the contribution of contamination from soils to groundwater; and
- Eliminate direct contact with contaminated building structures.

The remedial design will meet each of the above remedial objectives for the Site as follows:

*Objective - **Eliminate** the potential for direct human contact with the contaminated soils and groundwater on site.*

In order to eliminate the potential for direct human contact with the contaminated soil and groundwater, the selected remedy will incorporate a multi-layered cap over the consolidated soil and debris. This cap will provide a physical barrier, preventing direct physical contact with contaminated media.

*Objective - **Eliminate** off-site migration of contaminated soils and surface water via storm-water runoff.*

Off-site migration of contaminated soils and surface water will be eliminated by excavation of off-site contaminated media and consolidation on the Site. Site soils and consolidated soils and sediments will be covered with a cap which will prevent direct contact of storm water with contaminated soils/sediments and divert storm water off of the site.

*Objective - **Minimize** to the extent practicable, the contribution of contamination from soils to groundwater.*

The contribution of contamination from soils to groundwater will be eliminated by the excavation of contaminated soil and by the use of a cap to prevent leaching of lead to the groundwater. Contaminated soils on the Universal property, which contains the primary groundwater flow path from the Site, will be removed and consolidated under the cap. The soils remaining on the Universal property will be clean soils, further limiting the potential for leaching of contaminants into groundwater.

*Objective - **Eliminate** direct human contact with contaminated building structures.*

Direct human contact with contaminated building structures will be eliminated through demolition of the contaminated structures and consolidation of the contaminated building debris on site.

The main elements of the selected remedy, which have been designed to meet these objectives as stated above and as presented in the ROD and RDWP, include the following:

- Excavation of lead-impacted soil and sediment from off-site areas and consolidation on-site;
- Building demolition and on-site consolidation;
- Capping;
- Clean soil backfilling;
- Groundwater monitoring;
- Maintenance; and
- Institutional Controls.

This Pre-Final Design Report addresses each of these remedial design components to fulfill the requirements of the ROD.

1.3 Site Description

The Site is comprised of two separate units: the Bern Metal property and the Universal Metal property as presented on Sheet 1. Due to the close proximity of these two properties, NYSDEC has registered the units under one site registry number. The Bern Metal property was primarily used to reclaim metals from automotive batteries and for reprocessing/recycling of metal powders, and scrap metal. The Universal Metal property was primarily used for recycling scrap metal. The facilities located on the Bern Metal property are currently not in use. Operations at the

Bern Metal property primarily occurred from 1938 to 1983. The Universal property is currently being used by the property owner for storage of scrap automobiles. The entire Site covers an area of approximately 5.2 acres.

1.4 Purpose and Organization of Report

This report presents the general design and implementation requirements for reclamation activities at the Site, and has been organized into the following sections:

- Section 1 - Introduction
- Section 2 - Engineering Design
- Section 3 - Preliminary Construction Schedule
- Section 4 - Remedial Action Contingency Plan
- Section 5 - Operation, Maintenance, & Monitoring Plan

The Site-Specific Health and Safety Plan, addressing construction, operations, and maintenance of the Site remedy is provided as Appendix A to this report. The Air Monitoring Plan, addressing the ambient air monitoring program to be implemented to ensure protection of the surrounding community, is provided as Appendix B. The Construction Quality Assurance/Construction Quality Control Plan, addressing implementation of the remedy, is presented as Appendix C to this report. A summary of the pre-design investigations is included as Appendix D. Stormwater design calculations are included as Appendix E.

2. Engineering Design

2.1 General

This section presents the engineering design associated with the Site remedy. This design has been prepared to achieve the requirements set forth in the ROD. In particular, as discussed in the ROD and the RDWP, this design has been prepared to achieve clean closure of the Universal property and other adjoining areas by removing impacted soil and consolidating these soils onto the Bern Metal property prior to installation of the final cap over the Bern Metal site. The excavated areas will be restored through placement of clean backfill materials.

The primary engineering design components include the following:

- Site Preparation;
- Building Demolition and Debris Management;
- Excavation/Consolidation of Impacted Soils onto the Bern Metal property;
- Capping of the Bern Metal property;
- Storm Water Management; and
- Perimeter Fencing.

Engineering plans and material and performance specifications are included in this report following the narrative sections.

2.2 Site Preparation Activities

This section summarizes activities that will be performed to prepare the Site for subsequent remedial activities.

2.2.1 Mobilization

Under this task, the remedial contractor will mobilize the necessary field trailers to the Site for use as field offices for on-site personnel. It is anticipated that the field trailers will be mobilized on the Clinton/Bender properties. Four field trailers will be mobilized to the Site.

1. A trailer for the remedial contractor;

2. A trailer for the project consulting engineer (Engineer);

3. A trailer for the NYSDEC oversight personnel; and

4. A trailer for security personnel.

The remedial contractor will connect the trailers to the required utilities.

In addition to field trailers, the necessary construction equipment and materials required for the remedial action will be mobilized to the Site.

2.2.2 Site Security

This project will be conducted under strict site control and security to prevent unauthorized persons from entering restricted areas throughout the project. Temporary fences will be installed around excavation areas and to replace

any sections of fencing removed during site activities. Site security will be provided for all equipment, offices, and material at the Site. During implementation of the remedy, security will be provided seven days per week, 24 hours per day, including weekends and holidays). Security measures will be reviewed periodically to ensure adequate security coverage is being provided on the Site. If necessary, additional security staff may be provided.

The site security agency will be responsible for the control of all persons and vehicles entering and leaving the site during working hours. Security personnel will:

- Require proper identification for each person;
- Require personnel to sign in upon entering the site and to sign out when leaving;
- Maintain a log of all vehicles and equipment entering and leaving the site;
- Not allow visitors without the approval of the Site Superintendent or his representatives. Visitors will not be permitted to enter the work areas without proper health and safety training documentation; and
- Maintain a log of visitors.

Temporary field offices will be located on the Clinton/Bender properties, as previously referenced. The main entrance gate at the end of Bender Street will be locked at all times when there is no site activity, except for passage of authorized personnel and vehicles. A site log will be maintained for detailing all security incidents. The on-site security staff will also be in radio communication with each other, as well as the remedial contractor and Engineer. If any emergency situation occurs, the security agency, BBL, NYSDEC, and/or the remedial contractor will contact law enforcement officials, emergency medical care units, local fire departments, and utility emergency teams to ascertain the type of response required and to coordinate the responses of the various units. A list of emergency contacts, with telephone numbers, will be posted on site.

2.2.3 Clearing/Grubbing

Prior to performing any Site work, the Bern Metal, Universal Metal, and those affected portions of the surrounding properties will be cleared and grubbed. Trees and brush will be removed to the ground surface using heavy construction equipment, chain saws, and brush hogs. The cleared vegetative materials will be temporarily staged on-site and placed on the Bern Metal site prior to installation of the cap.

There is currently a minor amount of surficial debris on the Bern Metal property. Any large surficial debris which is not considered appropriate for consolidation under the cap will be removed for off-site disposal in accordance with applicable regulations.

The Universal Metal property is currently being used by the property owner; therefore, arrangements will be made between the Site Respondents and the property owner to relocate all vehicles and associated automotive and scrap metal debris during construction activities.

2.2.4 Temporary Access Roads

This section addresses the requirements for modifications of a temporary access road (i.e., unpaved Conrail roadway) along the Conrail right-of-way to serve as the required route for truck traffic. Improvements to the temporary access road(s) will be required for truck traffic on unpaved portions of Conrail right-of-way while

transporting soil from and onto the Conrail South property. If material excavated from the Conrail South property is to be conveyed directly across the Conrail tracks dividing the Conrail South and Bern Metal properties, then access road improvements will not be required. The requirements for either of these options are discussed in more detail below.

Improvements to the existing Conrail roads will be performed to control dust and visual impacts (e.g., tracking) associated with material transport from the Conrail South property. The section of the existing access road to be improved will begin on the Conrail South property, at the soil loading area (Section 2.4.2.2, below). It will lead to two permanent rail crossings location on the Conrail South property and will follow the required route for truck traffic entering and leaving this property, ultimately leading to a nearby public roadway. The specific route for the access road will be determined by the remedial contractor and approved by Conrail prior to construction.

Truck traffic in other areas of the Site will be primarily limited to on-site areas and immediately contiguous properties. Therefore, other temporary off-site access roads are not anticipated. Temporary on-site access roads will be constructed by the remedial contractor, as necessary, to reduce fugitive dust emissions, or to provide a barrier between truck traffic and impacted soils. The temporary access road(s) will be constructed by placing a six-inch layer (minimum) of gravel, crushed stone, or other suitable material onto a geotextile filter fabric. The temporary access road will be twenty feet wide, and will be lead from a clean area within the permanent rail crossing at the Conrail South property.

2.2.5 Construction of Erosion Control and Storm Water Management Structures

Temporary erosion control and stormwater management structures will be installed around the Bern Metal property perimeter to control storm water runoff and sediment during cap construction. These controls will be installed prior to initiating construction activities. Inspection and proper maintenance of these controls will be performed as an integral component of Site maintenance during construction. These controls will consist of a perimeter silt fence and hay bales, and sedimentation control structures around the existing stormwater catch basins on the Bern Metal property. Installation of temporary erosion control structures around the excavation perimeter is discussed in Section 2.4.

A silt fence will be installed around the perimeter of the Site and associated excavation areas to collect sediment-laden runoff. The silt fence will consist of perimeter hay bales placed immediately adjacent to a three-foot high silt fence. The hay bales will be secured to the ground with stakes or equivalent, and the silt fence will be anchored a minimum of six inches into the ground and staked every ten feet. The silt fencing will be installed along the perimeter of excavation areas and along the toe of any temporary stockpiles or regraded areas (i.e., the perimeter of the consolidated area).

The existing storm water inlet (catch basin) located on the Bern Metal site, adjacent to the Bender Avenue entrance will be protected to intercept and retain sediment contained in runoff. These catch basins were installed as part of the Clinton/Bender Removal Action and convey stormwater runoff to a 54" storm sewer on Clinton Street via a 12-inch PVC storm sewer running along Bender Avenue. The hay bales and a silt fence will encircle the inlet and will be staked or otherwise secured to prevent movement or openings in the barrier.

2.2.6 Site Survey

A survey of the site will be performed prior to implementation of excavation activities to establish baseline conditions. The existing limits of soil to be excavated will be located and staked. The remedial contractor will be responsible for placing and maintaining survey control stakes in excavation and fill areas for the duration of

construction. These stakes will note the depth of cut or fill required at various areas for the duration of construction. At the completion of each earthwork stage, the area disturbed during the previous stage will be surveyed to determine level of progress and conformity to the design. A survey will be performed of excavation areas at the completion of excavation within each property to document actual excavation volumes. In addition, a survey of the constructed subgrade and final cap will be performed to generate a topographic map of the area.

2.3 Building Demolition Plan

This building demolition plan addresses the demolition of on-site structures and the on-site management of the associated debris. The two on-site structures addressed under this plan include the Bern Metal building and the Bern Metal Office building.

The requirements for demolition and on-site consolidation of the Clinton/Bender properties will be presented to the NYSDEC under separate cover. Prior to placement of wood debris from the Clinton/Bender properties under the final capping system, an analysis will be made regarding the suitability of this additional volume of wood debris to be consolidated underneath the low-permeability capping system without addition of a gas venting layer as a component of the cap.

The Bern Metal warehouse building is a single story concrete block structure, approximately 100 feet long by 70 feet wide, located along the western end of the Bern Metal property. The interior of the structure is open, with one internal partition. The interior does contain some steel supports and duct work. The roof structure is constructed of corrugated steel sheets with structural steel framing. The building floors are constructed of wood. The Bern Metal office building is a single story concrete block structure, approximately 50 feet long by 20 feet wide, located at the northern end of the Bern property, along the property line. The Bern Metal office building contains some miscellaneous wastes. Prior to demolition, any non-structural material in the Bern Metal office building will be removed by the remedial contractor and disposed off-site in accordance with applicable regulations.

Prior to building demolition, the remedial contractor will obtain a demolition permit from the City of Buffalo. In accordance with City of Buffalo requirements, an asbestos survey will be performed and any existing building utility connections will be located and disconnected.

The building demolition will be performed by a qualified remedial contractor, in accordance with City of Buffalo requirements. During demolition, a water spray or equivalent will be used to control fugitive emissions. The building is located along the future cap perimeter, and it is anticipated that much of the debris resulting from demolition will require placement elsewhere on the Site. Concrete debris will be crushed to a size suitable for on-site management and to allow for consolidation underneath the cap. Debris sizing and placement will be performed at the discretion of the on-site engineer. Debris will be placed in interior areas of the site that will allow for a minimum of two feet of soil to be placed over the debris prior to cap construction. Following placement, debris will be compacted in place using two passes (minimum) of a roller (or equivalent). Debris will be compacted in place under the supervision of the on-site engineer.

Other debris generated from the Bern Metal building will include any portions of the wood floors that require removal, steel framing, roofing, equipment and duct work. Steel generated from building demolition may be sent off-Site for salvage. Any steel to be sent off-site for salvage will be cleaned with high pressure water or steam at the on-site decontamination pad to remove dirt or other materials from the surface. Decontamination water will be collected and containerized, and managed appropriately, in accordance with requirements outlined in Section 2.9. The NYSDEC will be notified of the intended salvage facility prior to sending any steel material off-site for

salvage. Following shipment, the remedial contractor will provide the appropriate documentation for the shipment and acceptance by the salvage facility.

2.4 Excavation/Consolidation Plan

This section discusses the excavation/consolidation component of the Site remedy. It includes an overview of the field sampling program performed at the Site to delineate the extent of soil located on the surrounding properties exceeding the site clean-up standards that will be excavated and consolidated onto the Bern Unit prior to cap installation. In addition, requirements for backfilling and restoration of the excavated areas is presented.

2.4.1 Pre-Design Investigation Results

The pre-design investigation was performed to determine the lateral and vertical extent of impacted soils requiring excavation from the adjacent properties. This investigation employed a phased approach to sample analysis to minimize the total number of analyses required for samples collected from the Site while yielding the necessary data to establish excavation limits. The Pre-Design Investigation Report, included as Appendix D, presents a narrative description of the Pre-Design Investigation performed by BBL in addition to the associated analytical results (including quality assurance/quality control samples).

2.4.2 Limits of Excavation

This section discusses the anticipated areal and vertical limits of excavation for each of the four adjacent properties. The anticipated limits of excavation were determined by the results of the pre-design investigation. In developing the excavation limits, it was determined that material would be excavated to the required depth and would laterally extend to the adjacent sample location. In addition, the top of clay layer will also serve as the vertical limit for excavation.

The discussion below presents the specific considerations associated with removal of impacted soils from each of these areas.

2.4.2.1 Laub Property

The limits of excavation on the Laub property extend from the Laub driveway, located along the western side of the Laub building, along the Bern Metal property line, to an area located south of the Laub building that was apparently impacted by former Bern Metal operations. The areal and vertical extent of the excavation is depicted on Sheet 2, Excavation Plan. A significant portion of the Laub soils to be excavated are below the site clean-up standards. This additional soil volume was incorporated into the excavation area to simplify the overall constructability of this excavation. The approximate in-place volume of soils to be excavated from the Laub property is 2,960 cubic yards.

2.4.2.2 Conrail South Property

The limits of excavation on the Conrail South property will extend from the railroad tracks between this property and the Bern Metal property toward the south. The depth of excavation in this area ranges from one to four feet below grade. Included in this excavation area will be the removal of ditch sediments along the southern side of the railroad tracks. The areal and vertical extent of excavation in the Conrail South property is shown on Sheet 2. The approximate in-place volume of soils to be excavated from the Conrail South property is 4,330 cubic yards.

2.4.2.3 Conrail Right-of-Way

The limits of excavation on the Conrail Right-of-Way include a small, limited excavation located immediately adjacent to the northwestern corner of the Universal property and a larger excavation area located along the southwestern perimeter of the Universal property, extending along the entire southern perimeter of the Bern Metal property. This excavation area will also include impacted sediments from the ditch located between the Conrail railroad track and the Bern Metal property. The excavation depths in this area range from one foot to three feet below grade. The approximate in-place volume of soils to be excavated from the Conrail right-of-way is 3,750 cubic yards.

2.4.2.4 Universal Property

The analytical results from the Universal property indicate that the maximum depth of impacted soils requiring excavation is five feet. Almost the entire Universal property will be excavated and consolidated onto the Bern property. The estimated areal and vertical extent of impacted soils to be excavated is shown on Sheet 2. The limits of excavation on the Universal property are defined by the property line along the northern edge (adjacent to Clinton Street) and the western edge, and by the existing retaining wall, Universal building and property line along the eastern side of the property. Excavation in the vicinity of Clinton Street will be to the Universal property line. Although Sheet 2 depicts a three-foot excavation in this vicinity, it is anticipated, based on the drop in elevation in this area, that the top of clay layer will be encountered at the property line at a fairly shallow depth. The approximate in-place volume of soil to be excavated from the Universal property is 6,970 cubic yards.

2.4.3 Monitoring Well Abandonment

Prior to implementation of construction activities on the Bern and Universal properties, all monitoring wells, with the exception of MW-7, will be abandoned. Monitoring well abandonment will be performed by a licensed driller in accordance with NYSDEC standard procedures. A BBL geologist will oversee all monitoring well abandonments. It is anticipated that monitoring well MW-7, which is screened in the filled portion of the portion of the Little Buffalo Creek located on the Site, will be protected during excavation activities on the Universal property. If damaged during construction activities, this monitoring well will be abandoned and replaced. The locations of monitoring wells to serve as post-closure monitoring points for this remedial action are discussed in Section 5.

2.4.4 Soil Excavation

2.4.4.1 Preparation

Excavation of impacted soils will be implemented following demolition and placement of the on-site structures and, if applicable, the Clinton/Bender properties. This will ensure that a maximum separation between the debris and cap is provided. The entire site, including all excavation areas, will be surveyed by a NYS-licensed surveyor to provide baseline data regarding site conditions. The survey will provide a pre-remedial condition, using ½-foot contours. Prior to the start of any excavation on the site or adjacent properties, a field delineation/stake out of all utilities will be completed. In addition, the appropriate boundaries and anticipated depths of excavation within each area will be staked, as depicted on Sheet 2, Excavation Plan. Silt fencing will be installed in those excavation areas which will receive runoff. It is anticipated, based on the fairly low level of topographic relief at the site that most excavation areas will be fully enclosed by the silt fencing. However, the specific locations of silt fencing within each excavation area will be determined by the Engineer. In addition to silt fencing, any areas which are not

currently bounded by permanent fencing will have temporary orange construction fencing installed around the excavation area to limit access.

2.4.4.2 Equipment

The clean-up objectives, as established in the ROD, have been used to determine the anticipated excavation depths in each area. Based upon the anticipated excavation depth in an area, the appropriate excavation and transport equipment will be selected for the task. In order to allow for inspection of underlying material by the Engineer and NYSDEC (i.e., verification of the underlying clay layer), only smooth-bladed equipment (bulldozers and backhoe buckets with no teeth) will be used for excavation.

2.4.4.3 Excavation Procedures

Excavation within each area will be to the depth depicted on the Excavation Plan, or to the top of clay layer, whichever is encountered first. Excavation activities will be performed in accordance with the HASP (Appendix A). Also, site air monitoring will be performed, as presented in the Air Monitoring Plan (Appendix B).

If the top of clay serves as the vertical limit of excavation, a minimum of six inches of clay will be removed. Based on information obtained in the RI, the underlying clay layer on the Bern and Universal properties is a gently undulating surface that generally slopes to the former Little Buffalo Creek channel, located in the Universal property. The top of clay layer is a brown lacustrine clay. As discussed in the RI, this clay layer did not appear to be impacted by former site operations and, in many areas, defines the vertical extent of contamination. Following completion of excavation within an area, the Engineer and NYSDEC representative will inspect the excavated area and verify that excavation limits have been met. Following acceptance that the required excavation has been performed, a final survey of the excavated area will be performed to document the in-place volume of material removed.

Excavation/Loading on Laub/Universal/Conrail Right-of-Way Properties

The Universal property, the Conrail Right-of-Way, and the Laub property are immediately adjacent to the Bern Metal property, which will allow for use of dedicated on-site equipment that will be able to travel within the confines of the Site during excavation activities. For excavation areas at depth (i.e., greater than two feet), soils will be excavated using a trackhoe or equivalent. The trackhoe, bucket loader, or equivalent will be used to place excavated soil in a truck. Shallow excavation areas (i.e., less than two feet) immediately adjacent to the Bern Metal property may either be excavated and placed in a truck (as described above), or scraped off and pushed directly onto the site. Dedicated on-site trucks and excavating equipment will be used for these areas so that no off-site travel will be required. Excavation of areas along the outer extent of the limits of excavation will be performed so that the excavation and transport equipment will be located entirely within the Site to minimize potential impacts to uncontaminated areas.

Excavation along the Conrail Right-of-Way will require that equipment not encroach upon railroad tracks. The access agreement to be obtained between Conrail and the remedial contractor will establish these required setbacks.

Any on-site vehicles or equipment that have come in contact with impacted soils will be decontaminated prior to leaving the site. Decontamination will primarily be performed at the on-site decontamination pad. Because the asphalt decontamination pad will be removed during construction of the subgrade, a temporary decontamination pad will be used for decontamination of equipment following removal of the asphalt decontamination pad. Decontamination procedures are discussed in Section 2.9.

Excavation/Loading of Perimeter Drainage Ditch

Removal of sediments from the perimeter drainage ditch located on both sides of the Conrail railroad track at the southern end of the Bern Metal property will be performed in conjunction with the excavation of the Conrail Right-of-Way property. The ditch sediments will be removed to a depth of one foot or to the top of clay layer, whichever is encountered first. Sediments will be removed from the base of the ditch and along each bank of the ditch up to the required setback from the railroad tracks established by Conrail. Excavation and restoration of the drainage ditch sediments will require that equipment not encroach upon railroad tracks. The access agreement to be obtained between Conrail and the remedial contractor will establish these required setbacks. It is anticipated that this setback will be fifteen to twenty feet from the track centerline. Prior to removal of the sediments, the remedial contractor may remove the rip rap and/or ballast lining the ditch. Rip rap/ballast which is in direct contact with sediments will be removed along with the underlying sediments. If this material is removed, it will be temporarily staged on-site and replaced following excavation and backfill of the sediments.

Excavation/Loading on Conrail South Property

Excavation of impacted soils from the Conrail South property will have several additional considerations over the work to be performed in the other areas. The foremost consideration associated with work in this area is safety. The Conrail South property is bounded by three active railroad lines, so care must be taken at all times to ensure personnel or equipment does not encroach upon the required setbacks established by Conrail. An access agreement with Conrail will be required prior to working in this area; this agreement will establish additional requirements associated with working in this area. The required setbacks for the pre-design investigation were twenty feet from the centerline of the track running along the western edge of this property and fifteen feet from the centerline of the track running between the Conrail South property and the Bern Metal property.

The remedial contractor will be responsible for transporting excavated soil onto the Bern property. Transport of soil onto the Bern property will utilize one of two possible alternatives:

- Construction of a railroad crossing between the Conrail South property and the Bern property, and transport of excavated soil directly over the tracks; or

- Transport of excavated soil from the Conrail South property via the existing railroad crossing, and onto access roads utilized by Conrail. Excavated soil would be transported to the Bern property via Conrail access roads and public roadways. This alternative would require construction of temporary access roads over those unpaved (i.e., dirt) portions of Conrail access roads.

These alternatives are described in more detail below.

Alternative 1 - Direct Transport of Excavated Soils via Railroad Crossing Between Conrail South and Bern Properties

The first activity to be performed if this alternative is selected is to obtain approval from Conrail for the construction of a railroad crossing between the Bern and Conrail South properties. The remedial contractor would be solely responsible for obtaining approval to construct a crossing and for actual construction of the crossing in accordance with Conrail requirements. Construction of the crossing would require fill be brought onto the site to provide a level crossing over the ditches. Some excavation of the impacted soils may be required to allow for construction of the crossing. If excavation was to occur, these soils would be temporarily staged on the Conrail South property until the crossing was constructed. Following completion of the crossing, excavated soils would

be loaded directly into trucks, and transported directly across the tracks via the crossing. Following completion of excavation, the trucks would be decontaminated prior to leaving the Site.

Alternative 2 - Clean Loading and Transport of Soils via Existing Railroad Crossings, Conrail Right-of-Ways, and Public Roadways

In addition to the Conrail requirements/restrictions, under this alternative, excavation and loading of impacted soils from the Conrail South property will require implementation of "clean loading" procedures to minimize the contact between impacted soils and the equipment used for excavation and transport, in addition to ensuring that contaminants are not spread onto adjacent properties or roadways from transport vehicles. Dedicated excavation, loading, and transport equipment will be utilized.

The excavation in this area will be performed simultaneously with backfilling operations to minimize the required area of excavation face at any time. A trackhoe, or equivalent, will be used for excavation and loading of soils from this area. The excavation equipment will be positioned along the outside edge of the excavation area so that the wheels/tracks are not in contact with impacted soil. The initial excavation will be performed to remove the southeastern grid (bounded by sample locations CS-13, CS-15, CS-25, and CS-23) to a depth of one foot (the required limit of excavation). The excavation will be initiated along the perimeter of this grid, from an uncontaminated area. Excavated soils will be loaded directly into a truck, initially positioned outside of the grid on a temporary access road leading to the permanent crossing on this property. The truck will be lined with polyethylene sheeting to prevent materials from spilling out during transport. As soil is removed to the required depth, the trackhoe and truck will progress into the grid without any contact between the wheels/tracks and impacted soil. The excavation will progress into the adjoining grids. Clean backfill will be brought onto the area to replace excavated soil as necessary.

Following loading, the bed of each truck will be covered with a tarp to prevent spillage or dusting of soils during transport. The truck exterior, wheels, and undercarriage will be inspected for the presence of any soil. If necessary, the truck will be decontaminated prior to leaving the area. A temporary decontamination pad will be constructed on the Conrail South property. The temporary decontamination pad will consist of 30-millimeter polyethylene sheet, sized to fully contain any trucks or vehicles, with a bermed perimeter. At least one side of the bermed perimeter will be easily removed when the pad is not in use to allow for runoff. The decontamination pad will be installed so that water will drain to a sump. Water collected in the sump will be containerized in drums and managed by the remedial contractor in accordance with applicable regulations.

Excavated soils will be transported via temporary access roads and public roadways directly to the Bern property for placement.

Excavation on the Bern Metal Property

Soil along the perimeter of the Bern Metal property will be excavated and pulled back onto the site to allow for placement of the cap within the confines of the Site boundary. The soil will be pulled back a minimum of eight feet from the property line so that impacted soil is covered by the low-permeability layer of the cap. In addition to the perimeter of the site, additional excavation on the Bern Metal property will be required in the vicinity of the asphalt decontamination pad. The asphalt will be removed, and underlying soils pulled back to allow for cap placement. In order to maximize use of the decontamination pad, removal of the cap will be performed as the final area to be addressed.

Following removal of the decontamination pad, subsequent decontamination activities will be performed on the Clinton/Bender properties or on the Universal property, following excavation and backfilling operations. Construction and operation of the temporary decontamination pad will be similar to that used for excavation activities to be performed on the Conrail South property.

2.4.5 Consolidation of Impacted Soil

Excavated soils will be brought to the Bern Metal property and placed in twelve-inch lifts. Each lift will be compacted with a roller, using a minimum of two passes. Placement of soil will be overseen by the Engineer. The lifts will initially be placed along the southern portion of the site, progressing toward the north, to maintain access to the site from Bender Street and to maximize use of the on-site asphalt decontamination pad. Material will be placed and compacted to achieve the required grades. Final grading of the subgrade will be performed prior to construction of the cap. Equipment used for placement, compaction, and grading will be decontaminated prior to leaving the site.

2.4.6 Backfilling/Restoration of Excavated Areas

Backfilling of excavated areas will be performed following completion of excavation within each area. Excavated areas will be backfilled with bank run fill, or equivalent. The remedial contractor will identify the New York State Department of Transportation (NYSDOT)-approved backfill source(s). A composite sample of backfill materials will be obtained from each source area. Three discrete samples from a source area will be collected and submitted to an analytical laboratory to form one composite sample for analysis of Target Compound List (TCL) volatile and semi-volatile organic compounds, Target Analyte List (TAL) metals, pesticides/polychlorinated biphenyls, and herbicides in accordance with United States Environmental Protection Agency (USEPA) Methods 8260, 8270, 6000/7000 Series, 8080, and 8150. The results of the analyses will be compared to site-specific soil cleanup criteria (750 mg/kg for lead) and/or NYSDEC Technical and Administrative Guidance Memorandum (TAGM 4046) Soil Cleanup Objectives and Cleanup Levels.

Backfill will be placed in the excavation in 12-inch lifts and will be compacted after each lift with a roller or vibratory compactor. The top six inches of soil in the backfilled areas will be of a type which can support vegetative growth. The areas will be backfilled within six inches of existing topography. For the Universal property, the area will be backfilled to the elevation depicted in the Site Plan, and will not be backfilled to the existing elevations altered by the placement of fill materials by the Site owner.

Some limited areas to be excavated are currently covered with gravel/crushed stone. These areas include a portion of the Laub driveway, the area behind the Laub building, and a small portion of the Universal property adjacent to the building. A layer of No. 2 crusher run, or equivalent, will be placed and compacted on the compacted backfill in those limited areas. These areas will include that portion of the Laub property which are currently covered with crushed stone.

Unpaved areas to be backfilled will be seeded with a seed-fertilizer-mulch mixture.

2.5 Fugitive Dust Control Plan

This section addresses standard and contingent fugitive dust suppression measures to be implemented as an integral component of the remedial action for the site. The components of the fugitive dust control plan include the following:

- Identification of fugitive dust sources;
- Ambient air monitoring action levels;
- Baseline dust suppression measures; and
- Contingent dust suppression controls.

2.5.1 Fugitive Dust Sources

This section identifies potential fugitive dust sources associated with remedial action activities. These sources include those associated with typical remedial construction projects, such as excavation, material handling and transport, and material placement and grading. This fugitive dust control plan addresses fugitive dust control associated with handling of impacted soils at the site. The following specific fugitive dust sources have been identified for this remedial action:

- Excavation and soil handling;
- Vehicular traffic; and
- Soil stockpiles.

Excavation and Soil Handling

Fugitive dust can be generated during soil handling operations, such as excavation, loading, material placement, and grading. The primary contributing factors to fugitive dust emissions at the point of excavation are material properties (moisture and PM-10 content), geometry of the excavation face, bucket capacity, drop heights, excavation rate, and meteorological conditions, including wind speed and precipitation.

Excavation and handling of soils can potentially result in fugitive dust emissions. Because a significant portion of excavation work will occur adjacent to site boundaries, the potential for action levels to be exceeded at the property line are higher. Additional controls will probably be required to ensure ambient air monitoring levels are not impacted.

Vehicular Traffic

The primary source of fugitive dust from vehicular traffic is a result of contact between the vehicle wheels and ground surface. Fugitive dust emissions associated with movement of vehicles both on-site and on any constructed temporary access roads are a function of vehicle speed, vehicle weight, number of wheels, silt content of the road material, moisture content of the road material, and frequency of precipitation events. Of these factors, control of moisture content and vehicle speeds for on-site areas will be implemented as the primary fugitive dust control measures. Off-site temporary access roads will be used to limit fugitive dust emissions associated with truck traffic that may be required to access the Conrail South property via currently unpaved access roads on Conrail right-of-ways.

Soil Stockpiles

Material stockpiles include working piles and construction of the cap subgrade. Fugitive dusts associated with stockpiles are generated during materials transfer onto and off of the piles and wind erosion. Significant contributing factors include silt content, moisture content, stockpile dimensions/alignment, wind speed/direction, and the general stockpile activity.

2.5.2 Ambient Air Monitoring Action Levels

The ambient air monitoring program will consist of up to four perimeter monitoring stations located along the site perimeter. The monitoring program will collect data from an upwind location in addition to downwind perimeter locations. The ambient air monitoring program is presented as Appendix B.

Normal operating conditions for fugitive dust control are dictated by ambient air monitoring results. In accordance with the NYSDEC TAGM No. 4031, "Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites (October 27, 1989), the ambient air monitoring action level for PM-10 is 150 ug/m^3, integrated over a fifteen minute period. If the 150 ug/m^3 action level is exceeded, then a background measurement of downwind levels is taken. If the downwind levels are less than 100 ug/m^3 greater than the upwind levels, then no further action is required. In addition, because fugitive dusts generated at this site have the potential to be impacted by lead, an additional standard of no visible dust at the property lines will also be implemented as part of this project, in accordance with TAGM No. 4031.

2.5.3 Baseline Dust Suppression Operations

Baseline dust suppression operations are those which will be conducted under normal operating conditions to ensure appropriate fugitive dust suppression techniques are utilized throughout the project. Baseline dust suppression will not be implemented during and after precipitation events that achieve the equivalent dust suppression as the methods presented below.

Excavation and Soil Handling

The primary dust suppression technique to be utilized during soil excavation and handling operations will be water spray. Water will be sprayed onto the excavation face. The rate at which water is applied to the excavation face will be a function of the general activity in the area (excavation rate, number of vehicles actively operating), the moisture content of material being excavated, the proximity of the excavation to the property line, wind speed and direction, precipitation, and excavation geometry. Water will be applied evenly over the excavation face to that level required to prevent visible particulates at the relevant property line. The effectiveness of fugitive dust controls will be evaluated through the use of real-time monitoring and collection of samples for analysis of PM-10. The use of water spray will be optimized so that fugitive dusts are sufficiently controlled, while preventing generation of surface-water run off.

Due to the anticipated variability of conditions to be encountered at the excavation face, there is no way to accurately identify the appropriate rate and frequency of water spray to address each specific condition. Water will be applied to the excavation face using a method which evenly distributes water over the application area, such as a spreader bar.

Access Roads

Existing access roads will be improved by placement of crushed stone on Conrail right-of-ways to allow for transport of impacted soil from and clean backfill to the Conrail South property. In addition, temporary access roads may be constructed on-site to minimize fugitive dust emissions associated with on-site vehicle traffic. Temporary access roads will be constructed of aggregate material with little fine-grained material. Dusting associated with traffic on these roads is not anticipated to be significant. If necessary, primary dust suppression techniques to be utilized on the access roads will be water application using a spreader bar and restrictions on vehicle speeds, or application of calcium chloride (or equivalent). The rate at which water or calcium chloride is

applied to access roads will be a function of the general activity in the area (number of vehicles actively operating), the proximity of the road to the property line, wind speed and direction, precipitation, and the road construction. As with the excavation face, water spray will be applied as necessary to control fugitive dusts that will also minimize impacts to operations and generation of surface-water run off.

Vehicle speeds on interior access roads will initially be limited to 10 miles per hour. The maximum allowable vehicle speeds may be increased or decreased throughout the project as additional information is obtained regarding the impacts of vehicle movement on-site.

Stockpiles

The primary dust suppression techniques to be utilized on the stockpile areas will be determined by the remedial contractor. Potential alternatives to address fugitive dust emissions from undisturbed stockpiles include water spray, crusting agents (i.e., calcium chloride), surfactants, erosion control mats, or wind screens. The stockpiles which have the highest potential for generation of fugitive dusts are temporary, working piles, which have not yet been placed onto the subgrade. Water spray will represent the primary method of fugitive dust control for active stockpiles. The constructed subgrade may also pose some potential for fugitive dust emissions prior to final cap construction. For the constructed subgrade, fugitive dust suppression techniques will primarily utilize more permanent techniques that will not require periodic application. If utilized, water spray will be applied at a sufficient rate to control fugitive dusts that will also minimize impacts to operations and surface-water run off.

2.5.4 Contingent Dust Suppression Controls

This section addresses the increased levels of controls to be implemented on a temporary basis when ambient air monitoring levels indicate their necessity. If frequent contingent dust suppression controls are required, then the baseline dust suppression operations will be reevaluated for their effectiveness, and modified as necessary. Modifications to baseline dust suppression techniques may consist of the use of surfactants or crusting agents ($CaCl_2$), increases in water spray rates and/or frequencies, or temporary covers over material stockpiles.

Contingent Ambient Air Monitoring Action Levels

Exceedances in the ambient air monitoring action levels will trigger increased level of fugitive dust suppression, defined as contingent fugitive dust suppression operations. Two levels of contingent fugitive dust suppression operations will be implemented under this project: Level 1 and Level 2:

- Level 1 contingent operations will be implemented following two successive measurements greater than the ambient air monitoring action levels (30 minutes).
- Level 2 contingent operations will be implemented following two successive measurements greater than the ambient air monitoring action levels following implementation of Level 1 contingent operations.

Level 1 Contingent Fugitive Dust Suppression Operations

The first step under Level 1 conditions will be to identify the potential sources (i.e., excavation face, access roads, etc.) which represent the primary contributing factor to the exceedance in action levels. This will be done as quickly as possible, primarily by visual inspection of those potential sources which appear to be generating the most dust. Other potential contributing factors will be evaluated (i.e., windier conditions coupled with proximity of the area to the property line). In addition, a Miniram (or equivalent) may be used to identify the primary contributing source(s), if visual inspection cannot identify it.

Following identification of specific contributing sources, water spray will be reapplied at an increased rate (over the baseline application rate) which is sufficient to ensure materials within the affected area are all sufficiently wetted down. If a specific area cannot be identified, then water spray will be reapplied to all potential source areas. Following implementation of Level 1 operations, perimeter ambient air monitoring results will be evaluated to determine the effectiveness of the additional controls. If two successive readings indicate the site is still not within the required ambient air monitoring action levels, then Level 2 operations will be initiated. Otherwise, the site will be returned to baseline fugitive dust suppression operations.

2.5.5 Level 2 Contingent Fugitive Dust Suppression Operations

Level 2 contingent operations will consist of an increased level of evaluation of overall site conditions in order to identify any other potential sources that may be contributing to the exceedances in ambient air monitoring levels. Each potential fugitive dust source will be visually reinspected, and particulate levels will be measured immediately downwind with a Miniram (or equivalent).

Level 2 controls will be applied to any specific sources that are identified as primary contributors to the measured exceedances in perimeter ambient air monitoring levels. If Level 2 conditions are encountered, the water spray will be augmented with a surfactant or crusting agent to assist in the overall effectiveness of the dust suppression.

Following implementation of Level 2 controls, perimeter ambient air monitoring results will be evaluated to determine the effectiveness of the additional controls. If compliance with the ambient air monitoring levels is achieved for two successive monitoring periods (30 minutes), then the site will be returned to baseline operating conditions. If two successive readings indicate the site is still not within the required ambient air monitoring action levels, then those site operations which are identified as the primary contributors to the exceedance will be temporarily suspended, as described in Section 4.4.

Temporary Operations Shutdown

Temporary shutdown of all or part of the Site operations will be initiated when the use of Level 2 fugitive dust suppression controls does not lower perimeter ambient air monitoring levels to below the established action levels. It is anticipated that the primary reason this condition would be implemented would be during unstable weather conditions (i.e., high winds). If operations, or a portion of operations, are shut down temporarily, potential emissions associated with wind erosion (i.e., from stockpile areas, the excavation face, or the landfilling operations area) will be addressed through additional application of water spray, surfactants, crusting agents, or covering with erosion control mats in the specific areas of concern. Following a return to more stable weather conditions, the site will be returned to baseline fugitive dust suppression conditions.

2.6 Cover System Design

The site remedy calls for a multi-layered cover system with a geomembrane barrier to be installed at the site following excavation and consolidation of impacted off-site soils. The cover system has been designed to provide a barrier that will prevent direct contact with contaminated soils and that will minimize infiltration through the contaminated soils. The cover system will be placed to the limits and configuration shown on Sheet 5-Final Grading Plan.

The proposed cover system, which is depicted on Sheet 7- Details, will consist of the following components (from top-of-subgrade to final ground surface):

- A 10 ounce per square yard non-woven geotextile cushioning layer as specified in MP Section 02232 Geotextile. The non-woven geotextile will overlie the final subgrade depicted on Sheet 4-Subgrade Grading Plan and provide a cushion layer that will protect the barrier component of the cover system from potential protrusions in the subgrade.

- A 60 mil thick High Density Polyethylene (HDPE) as specified in MP Section 02234 Geomembrane. The HDPE liner will provide the barrier component of the cover system.

- A geosynthetic drainage composite (GDC) as specified in MP Section 02219. The GDC will convey stormwater that infiltrates through the overlying barrier protection soil off of the cover system. This drainage feature will prevent a build-up of water on the barrier layer.

- A twelve-inch thick layer of barrier protection soil as specified in MP Section 02221 Soil Fill Material. This layer will protect the barrier component of the cover system from damage due to sunlight, weather conditions, or human/animal contact, and provide base for topsoil and seeding.

- A six-inch layer of soil suitable for supporting vegetative growth as specified in MP Section 02212. This layer will be constructed with locally available soils, which will be seeded with a seed-fertilizer-mulch mixture following installation.

The final cover system footprint will lie entirely within the Bern Metal property. The cover system will be constructed with 25% side slopes along the perimeter. Intermediate side slopes will transition to approximately 10%, with the minimum top slopes being 4% (minimum) to promote runoff.

The final grading plan was prepared using an assumed approximate fill volume of 30,000 cubic yards. As discussed in Section 2.4, the estimated in-place volume of impacted soils to be excavated and consolidated on-Site is approximately 20,000 cubic yards. The estimate of 30,000 cubic yards therefore provides sufficient flexibility with respect to swell of excavated soils and fluctuations in the excavation estimate, to allow for an overestimate.

2.7 Stormwater Management Design

2.7.1 Temporary Controls

Temporary stormwater controls consisting of silt fencing and haybales will be utilized during remedial construction activities to minimize the potential for erosion and off-site migration of soil material. Silt fencing will installed along the perimeter of all proposed remedial excavation areas and the area designated for excavated material consolidation (area of proposed cover system construction). In addition, silt fencing will installed around areas to be used by the remediation contractor for equipment and material storage. Where necessary, haybales will be used in place of silt fencing or to add additional support to installed silt fencing.

2.7.2 Permanent Controls

Permanent controls will be used to manage post construction stormwater runoff associated with the 25 year, 24 hour storm event. The permanent controls consist of a number of drainage swales and ditches which have been designed to collect and convey surface water runoff in a controlled manner to select locations for offsite discharge. A summary description of each component is provided below. Design calculation for the permanent stormwater controls is provided in Appendix E.

2.7.3 Mid-Slope Drainage Swale

Mid-slope drainage swales will be constructed along the side slopes of the proposed cover system for the purpose of intercepting sheet flow runoff. The collected runoff will be conveyed within the mid-slope drainage swales to the proposed outlet drainage ditch located at the southerly end of the Bern Metal site.

To minimize the potential for scour within the swale invert, erosion control matting will be installed to stabilize the swale until vegetation is established.

2.7.4 Perimeter Drainage Ditch

A drainage ditch (perimeter drainage ditch) will be constructed around the perimeter of the proposed cover system. The perimeter drainage ditch will serve to intercept runoff occurring below the mid-slope drainage swales. A portion of the collected runoff conveyed to within the perimeter ditch to the proposed outlet drainage ditch. The remainder of the collected runoff will be conveyed to two existing drainage catch basins located at the northerly end of the Bern Metal site next to Bender Ave. The amount of storm water runoff has been calculated for an established, vegetated cap based on a 25-year/24-hour duration storm event. It is estimated that 1.0 cubic feet per second (cfs) of storm water will be conveyed to catch basin CB-1 and CB-2, each (for a total of 2 cfs to the Bender Avenue storm sewer), under established or vegetated conditions from the referenced storm event.

To manage potential scour within the perimeter drainage ditch, the ditch side slopes will be lined with stone material and vegetation. Stone material will be placed along the interior of the ditch to provide both scour protection for flow within the perimeter ditch and to allow for drainage from the cover system geosynthetic drainage composite. The opposing ditch side slope will vegetated with grass.

2.7.5 Outlet Drainage Ditch

The outlet drainage ditch, which is to be constructed at the southerly end of the Bern Metal site, will collect runoff from both the mid-slope drainage swales and the perimeter drainage ditches. Runoff within the outlet drainage ditch will be conveyed to the existing drainage ditch located between the Bern Metal site and the Conrail railroad tracks. Rip rap material will be placed within the existing drainage ditch at the point of intersection with the outlet ditch to provide additional stabilization to the existing ditch side slopes and to aid in reducing flow.

2.8 Perimeter Fencing

This section presents the requirements associated with installation of a new perimeter fence around the final capped area on the Bern Metal property, in addition to replacement of any fencing removed during work on the Universal property. The perimeter fence surrounding the Universal property will be installed following excavation and consolidation of impacted soils from the Universal property, with the exception of the portion of fence between the Universal and Bern Metal properties. This portion of the fence will be installed along with the entire perimeter fence surrounding the Bern Metal property. Installation of the perimeter fence around the Bern Metal property will be performed following completion of the cap installation.

2.8.1 Existing Fencing

The Bern Metal and Universal properties and a portion of the Conrail property are currently enclosed by a perimeter fence. During excavation activities, existing sections of fence will be removed as necessary to provide the required access to the site from adjacent areas and to allow for excavation of areas adjacent to fences. Removal of fencing

will, at a minimum require that the existing posts, chain link fence material, and three-strand barbed wire will be removed. If removed fence is in good condition, the remedial contractor may temporarily stage fencing sections for re-use during installation of the final perimeter fencing system. The majority of the perimeter fence surrounding the Universal and Bern Metal properties is in sufficiently good condition to allow re-use of this fence. Any sections of fence which are not considered suitable for re-use will be sent off-site for salvage or placed on-Site and incorporated underneath the cap. Fence material will be managed in the same manner as debris from the on-site building demolition.

2.8.2 New Fence Installation

This section addresses the installation of new fencing at the site. Fence to be installed will include both temporary fencing and permanent fencing.

2.8.2.1 Temporary Fencing

Temporary fencing will be installed around active excavation areas to limit access by unauthorized personnel. In addition, temporary fence will be installed following removal of any sections of the existing perimeter fence. Temporary fencing will, at a minimum, consist of orange construction fence. The purpose of the temporary fencing will be to limit access to excavation areas from unauthorized personnel.

2.8.2.2 Permanent Fencing

Permanent fencing will be installed around the Bern Metal property, following completion of cap construction, and around the Universal property, following completion of excavation/consolidation activities.

The Bern Metal property fence will be of the same type that currently surrounds the property. The fence will consist of a six-foot high, chain-link fence with three-strand barbed wire. Approximately 1,700 linear feet of fence will be installed around the Bern Metal property. One gate will be installed at the end of Bender Street to only allow access to the site from one location. No other gates surrounding the Bern Metal property will be replaced.

The Universal property fence will consist of six-foot high, chain-link fence with three-strand barbed wire. Approximately 900 linear feet of fence will be installed around the Universal property. The existing gate at the Universal property should not require removal during excavation activities, and will therefore remain in place. The Universal perimeter fencing will extend from the property line at the corner of Clinton and Bender Streets, to the west, following the property line at Clinton Street, then following the western property line towards the Bern property line. The common property line between the Bern Metal and Universal properties will be fenced in following completion of capping activities on the Bern Metal property. Long-term maintenance of the Universal fence will be responsibility of the current owner.

New holes for the new perimeter fences will be augered. Because the fence will be installed in previously excavated areas which will be consolidated underneath the cap, the augered soil will consist of new fill material and of underlying clay, which will not be excavated. The displaced soil will be spread/graded adjacent to the hole. Areas surrounding the fence installation will then be rough graded to prevent ponding of waters or any depressions.

2.8.3 Warning Signs

Warning signs will be installed during execution of the remedial activities; however, no warning signs will be posted following completion of the remediation activities. The warning signs will be 12" x 18" and will read

"Warning - Do Not Enter/Hazardous Waste Site." The signs will be installed at 100-foot intervals. For permanent fencing, the signs will be placed in the center of the fence. For temporary fencing, the signs will be attached to the fence or staked immediately in front of the fence.

2.9 Equipment Decontamination

Construction equipment used to handle impacted soils will be properly decontaminated before it exits the site. Initially, bulk quantities of soil will be removed from equipment that comes in direct contact with the excavated materials. The equipment will then be staged on either the Bern Metal asphalt decontamination pad, or (following removal of the asphalt decontamination pad) on a temporary decontamination pad, and cleaned to remove residual material. Decontamination will be performed using high pressure water and/or steam.

Decontamination waters will be containerized and managed in accordance with applicable regulations. It is anticipated that, based on previous work on the Site, decontamination waters will be acceptable for discharge to the sanitary sewer, in accordance with the City of Buffalo Sewer Authority (BSA) requirements. The remedial contractor will be required to obtain a sewer use permit from the BSA prior to discharging any decontamination waters to the sewer. Solids collected during decontamination will be placed onto the site, underneath the cap.

It is anticipated that temporary decontamination pads will be constructed on the Clinton/Bender site residential properties (following building demolitions), adjacent to the Bern Metal Site (to the north) and on Conrail property located immediately adjacent to the Conrail South area. The placement of these pads will be re-evaluated as work progresses and moved, if necessary, during remedial activities. Temporary decontamination pads will be constructed of 30-mil polyethylene sheeting (minimum) on a flat, solid surface. If necessary, a layer of crushed stone will be placed on the ground to provide a stable base for the pad. The decontamination pad will be sized to fully contain the largest piece of equipment to be utilized on-site. The sides of the decontamination pad will be bermed, using sand bags, or equivalent. The pad will be sloped to a low-lying corner, or sump, to allow for recovery of decontamination waters.

2.10 Permits/Approvals

Prior to implementation, the remedial contractor will be responsible for obtaining any required local building or demolition permits from the City of Buffalo.

2.11 Construction Cost Estimate

A construction cost estimate for this remedial action is included in Table 1. This estimate only includes capital costs associated with implementation of the remedial action and does not include long-term operations, maintenance, and monitoring costs.

3. Preliminary Construction Schedule

This section discusses the preliminary schedule for implementation of the remedial action. This schedule includes the anticipated time frames to obtain access agreements from Conrail and other approvals, and implementation of the remedial action. This schedule does not incorporate the time required to solicit bids and select a remedial contractor.

Item	Days
Obtain Access Agreement from Conrail and Other Necessary Approvals	60 days
Contractor Mobilize to Site	14 days
Site Preparation Activities	20 days
Excavation and Consolidation of Soils	40 days
Cap Construction/Perimeter Fencing	60 days
Demobilization	30 days
Submit OMM Plan	30 days

A final construction schedule will be developed to begin site mobilization efforts at or near the beginning of the construction season, in order to complete remediation activities in one construction season.

4. Remedial Action Contingency Plan

This Remedial Action Contingency Plan has been designed to address courses of action to be taken when responding to emergencies or other unexpected conditions that may be encountered during implementation of the remedial action. For situations requiring emergency action (i.e., fires, inclement weather, site evacuation), the courses of action referenced in this Remedial Action Contingency Plan parallel those required in the HASP for this remedial action. In the event of any of these emergency situations, the HASP will present a more detailed course of action; these emergency response procedures are also summarized in Section 4.1, below. Non-emergency type contingencies are discussed in Section 4.2.

4.1 Emergency-Related Contingencies

4.1.1 Fire Suppression/Control Plan

Fires that occur at the site will be handled by on-site personnel using on-site equipment when appropriate. Fire extinguishers will be maintained in all construction equipment, pick-up trucks, and office trailers. In the unlikely event that a fire that cannot be handled by on-site personnel occurs, the local fire department will be notified. The HASP presents a more detailed discussion on emergency contacts and chain-of-command in the event that a fire occurs on-site.

The on-site engineer will immediately report all fires that occur at the site to the local fire department, describing the nature of the fire, and whether or not additional fire equipment is needed. After the fire is extinguished, the Engineer will prepare a report identifying the cause and location of the fire, the method used to extinguish the fire, and corrective actions that may be performed to prevent that type of fire from occurring in the future.

4.1.2 Spill Control

Spill containment equipment will be available on site to isolate and contain spills that occur during remedial action implementation. The spill containment equipment will include:

- Reeled barricade tape;
- Spill control pillows, and blankets;
- Dikes;
- Emergency response guidebooks;
- Haz-Mat disposable bags;
- PPE;
- Haz-Mat disposal drums; and
- Dry absorbents.

Should a major spill of hazardous materials occur, the Engineer will immediately call the NYSDEC Spill Hotline (presented in the HASP), and a qualified NYSDEC-contracted spill response team will respond to contain and clean up the spill. The Engineer will prepare a report identifying the cause and location of the spill, the method used to clean up the spill, and corrective actions to be performed to prevent this type of spill from occurring in the future. A copy of this report will be provided to the appropriate project staff and to the NYSDEC.

4.1.3 Local Emergency Agencies

A copy of local emergency agencies is provided in the HASP. As discussed in the HASP, a list of the local emergency agencies, along with phone numbers, will be displayed within each office trailer at the site. Prior to

implementation of the remedial action, the appropriate local emergency agencies will be notified of the intended activities.

4.1.4 Site Evacuation Plan

The site evacuation plan is presented in the HASP. As discussed in the HASP, an air horn will be used to alert on-site personnel if an emergency situation requiring evacuation occurs at the site. This will signal on-site personnel to immediately evacuate the area and assemble near the site entrance located at the end of Bender Street. When all on-site personnel have assembled at the site entrance, a head count will be performed along with the appropriate instructions for evacuation.

4.2 Non-Emergency Related Contingencies

This section addresses those non-emergency related contingencies associated with inclement weather or with unexpected conditions encountered during remedial action implementation.

4.2.1 Inclement Weather Plan

This section identifies inclement weather conditions that may occur at the site and procedures that will be implemented to minimize interruption of Site operations and ensure the safety of on-site personnel. It should be noted that because this project can be completed within one construction season, the actual time of year for project implementation will provide the highest level of protection against any weather-related contingencies. The Engineer will monitor storm events and pending weather changes so the site can be operated during these conditions.

4.2.1.1 Freezing Conditions

A prolonged freeze can affect the performance of construction equipment, and poses potential concerns to on-site personnel (i.e., frostbite, hypothermia). In addition, installation of the geomembrane and other geotechnical materials is not recommended below temperatures of 40°F. The HASP addresses the potential concerns and corrective actions associated with cold weather and risks to personnel. If construction equipment malfunctions due to freezing conditions, the necessary corrective action will be implemented, as outlined in Section 4.3. In order to ensure the cap is properly installed, placement of the geomembrane will not occur when the temperature falls below 40°F. The risk for freezing conditions impacting cap placement will be minimized by restricting the start of cap construction to before October 1.

4.2.1.2 Snowfall/Winter Storms

As discussed in Section 3, this remedial action can be performed well within one construction season, so the risk of snowfall/winter storms impacting this remedial action is low. In the event that a late-season (spring) winter storm occurs, the appropriate snow and ice removal will be mobilized on site to remove snow/ice from operational areas within the site. As with freezing conditions, construction of the cap will not occur during winter storm events.

4.2.1.3 Heavy Rains and Electrical Storms

When a heavy rain event is forecast by the local weather bureau, the Engineer will inform on-site personnel to inspect the site erosion control measures and storm water management structures, and to report their findings so that the appropriate corrective actions can be implemented.

During heavy rain events or electrical storms, the Engineer may temporarily suspend operations and any on- or off-Site hauling activities until the weather improves. During these conditions, on-site personnel will immediately take refuge in on-site building structures or in rubber-tired vehicles.

Once the heavy rain event has subsided, on-site personnel will inspect the site erosion control measures and storm water management structures, and take corrective actions to repair damage before the next rainfall event.

4.2.1.4 Windy Conditions

During extremely windy weather, when construction equipment could become unstable, site operations will either be temporarily shifted to a sheltered area or suspended for the protection of field personnel. On-site personnel will exercise extreme care when excavating or placing soils during windy conditions due to the potential instability of the hauling vehicles in the wind. These same concerns also pose concerns regarding generation of fugitive dust.

4.2.2 Equipment Downtime

The remedial contractor will have backup equipment readily available from their shop or a local rental agency in the event of extended construction equipment breakdowns. A sufficient amount of equipment will be maintained on-site in order to adequately maintain Site operations in the interim period. The Engineer will review the project schedule with the remedial contractor to ensure that project schedule is not impacted significantly, and if necessary, measures are implemented to maintain the project schedule.

4.2.3 Perched Water/Low Lying Areas

Based on experiences gained during implementation of the Clinton/Bender remedial action, the presence of perched water and/or low lying areas at the site can result in extremely muddy conditions and require the handling of a significant volume of saturated soil as well as sloppy working conditions. The thickness of saturated soils in the vicinity of the top of clay decreases during dry periods. In order to minimize these concerns, it is recommended that excavation activities are implemented in spring, following completion of the major snow melt. This will result in the handling of drier soils and minimize the risks associated with management of saturated soils which may be encountered near the top of clay layer.

Saturated soils encountered during excavation will be stabilized and/or dewatered to the extent necessary to allow for removal, transport, and placement. Saturated soils may be transferred to the Bern Metal property only from the properties immediately contiguous to the Bern Metal property. The remedial contractor will provide the method for stabilization and/or dewatering prior to implementation. Potential methods for stabilization/dewatering include:

- Addition of fly ash, or other stabilizing agent;
- Addition of sorbent material;
- Addition of dry, unsaturated soils and mixing in place; and/or
- Dewatering of excavation.

In order to minimize the generation of water requiring management, preference will be given to those methods which do not require dewatering. If dewatering operations are performed, recovered groundwater will be temporarily containerized on-site and managed by the remedial contractor in accordance with applicable regulations.

If saturated soils are encountered on the Conrail South property, and the remedial contractor is utilizing public roadways to transport excavated soils to the site, then the saturated soils will be stabilized and/or dewatered prior to loading onto the truck. Only soils which are considered to be sufficiently dewatered (i.e., to a level that they would pass a paint filter test) will be allowed to be loaded into a truck and sent off-site.

4.2.4 Fugitive Dust Control

Fugitive dust control, including contingent procedures, is addressed in Section 2.5.

4.2.5 Excavated and Consolidated Soil Volumes

Estimates of the in-situ volume of soils to be excavated were made based on the analytical results obtained from the field sampling program performed in support of the remedial design. Based on this volume, a final grading plan was developed which incorporated an approximate increase of 50% in the volume of excavated/consolidated soils and any generated debris. The actual final configuration of the landfill is anticipated to deviate from the Final Grading Plan depicted on Sheet 4, based on the following contributing conditions:

- Variations in excavated volumes required for constructability purposes;
- Variations in excavated volumes based upon fluctuations in top of clay layer; and
- Deviations in the swelling of consolidated soils.

The anticipated final grades were designed to allow for variations in the final subgrade condition with minimal impacts to subsequent construction. If the final subgrade volume is significantly lower than anticipated, the cap sideslopes (10% to 25%) can be reduced during subgrade construction to minimize the resultant air space of the final subgrade. If the volume is anticipated to increase, the sideslopes and topslope can be increased to include the additional required volume. In addition, a final contingency would be to extend the cap footprint onto a portion of the Universal property that would provide the required additional capacity.

Surveys of excavated areas and the constructed subgrade will be made on a periodic basis throughout construction to monitor the actual volumes of excavated and consolidated materials. Any significant changes will be identified well before construction of the final subgrade is complete, to allow for any revisions to the final design.

5. Operation, Maintenance & Monitoring Plan

5.1 Introduction

This section presents the components of long-term operations, maintenance and monitoring (OMM) of the Site following completion of cap installation. As part of the long-term OMM, an OMM Plan will be prepared and submitted to NYSDEC.

The OMM Plan will:

- Outline the responsibilities and training requirements of personnel; and
- Provide OMM personnel with an outline of the inspection and maintenance procedures.

5.2 OMM Personnel Requirements

Personnel, including subcontractors, will perform specific tasks such as routine cap and fence inspection, as well as non-routine tasks such as cap, monitoring well, and fence maintenance/repairs.

5.2.1 Responsibilities and Duties

5.2.1.1 PRP Group

The PRP Group is responsible for the overall management of the Bern Metal site as part of the long-term maintenance program. The responsibilities include staffing, training and supervision of site personnel, budget control, site maintenance, record keeping, and preparation and submittal of reports.

The PRP Group is also responsible for financial aspects of the maintenance for the Bern Metals site. The PRP Group will secure a contractor to perform cap maintenance, as well as the periodic environmental groundwater sampling to meet the requirements specified in the ROD and NYSDEC-approved SOW.

5.2.1.2 Inspection/Maintenance Contractor

The inspection/maintenance contractor will be responsible for providing trained personnel to perform the routine and non-routine maintenance activities at the Bern Metal site. In addition, periodic inspections will be performed by trained personnel as outlined in Section 5.4 of this Work Plan.

5.2.1.3 Environmental Monitoring Contractor

The environmental maintenance contractor will be responsible for providing trained personnel to perform the environmental sampling in accordance with the schedule frequency outlined in Section 5.3.4 of this Work Plan.

5.2.2 Personnel Training

All field personnel will have completed OSHA 1910.120 (e) (2) 40-hour hazardous waste training. In addition, yearly 8-hour hazardous waste refresher training will be documented for all site personnel. Specialized training, as necessary, will be provided by contractors for their personnel.

5.3 Groundwater Monitoring Plan

5.3.1 Monitoring Well Locations

Groundwater flow across the Bern Metal site was determined to be in a general northerly direction from groundwater data collected during the Remedial Investigation. The groundwater monitoring well system for the Bern Metal site will consist of one upgradient well (RD-1) and three downgradient monitoring wells (RD-2, RD-3, and RD-4 if necessary), all located off the remediated Bern Metal site. Downgradient well RD-2 will be located immediately west of the former "lead-acid source area" (on the adjacent Conrail right-of-way property) near the southwest corner of the Bern Metal warehouse building. This monitoring well will, in essence, replace MW-3 which was installed during the RI and produced the highest analytical concentrations of dissolved lead. RD-3 will be located near the immediately north of the Bern Metal site, in the former Clinton/Bender site residential properties. Downgradient monitoring well RD-4, installed to replace MW-7, if necessary, will be located in the former Little Buffalo Creek stream channel on the Conrail right-of-way property. The approximate locations of the proposed monitoring wells are identified on Figure 4, Final Grading Plan.

5.3.2 Monitoring Well Installation

The monitoring well installations will be performed under the supervision of an experienced geologist. The monitoring wells will be installed at the off-site locations using 4-1/4-inch inside diameter (I.D.) hollow-stem augers. Standard split-spoon sampling will be performed to identify the top of clay surface at each monitoring well location. The depth to the top-of-clay unit may be very shallow (less than five-foot), therefore the length of well screen, sand pack thickness, bentonite thickness, and surface seal completion will be determined in the field by the supervising geologist. At a maximum, a five-foot length of 0.01-inch slot, 2-inch I.D. Schedule 40 PVC well screen will be used to monitor the groundwater associated with the fill material at the Bern Metal site. Two-inch I.D. Schedule 40 PVC flush-joint riser will be installed to approximately two feet above the ground surface. A two-foot thick sand pack (00N Grade Morie sand or equivalent) will be placed above the well screen, followed by a two-foot thick hydrated bentonite seal. The remaining annular space will be tremied with a cement/bentonite grout to the ground surface. A carbon steel protective casing will be set over the monitoring well risers. The PVC riser will be fitted with an adjustable j-plug and the protective casings will have keyed-alike locks. A concrete surface seal will be placed around the protective casing and mounded to promote drainage away from the well.

5.3.3 Groundwater Sampling Procedures

Upon completion of the monitoring well installation, each well will be developed to ensure a hydraulic connection between the screened interval of the monitoring well and the shallow aquifer. Each monitoring well be surged followed by the removal of a minimum of ten well volumes from each well. Care will be taken during well development to limit the constant surging of the well screen and sand pack in an attempt to reach a turbidity of less than 50 NTUs.

Groundwater sampling will be performed using low flow sampling procedures and appropriate equipment. Prior to the collection of groundwater samples, water-level measurements will be recorded to determine the static water level within the well casing. A peristaltic pump (or equivalent) will be used to purge groundwater at a flow rate of 200 to 500 milliliters per minute. The water level will be continuously measured to minimize drawdown (less than 0.3 feet) and document its stabilization. Groundwater samples will be collected upon stabilization of field indicator parameters (turbidity, temperature, specific conductance, and pH). Groundwater samples will be collected directly into appropriate sample containers.

5.3.4 Sampling Frequencies and Parameters

Groundwater samples will be collected on a semi-annual basis for lead for the first two years of the maintenance program, which is scheduled for a 30-year duration. Groundwater analytical data will be reviewed after two years to determine downward trends in total lead concentrations at each monitoring well. Should these trends be present, the sampling program will be performed on an annual schedule for the analysis of lead for the remainder of the maintenance program or until four consecutive lead concentrations are present below the maximum contaminant level (MCL) for lead.

5.3.5 Quality Assurance/Quality Control Procedures

The groundwater samples collected as part of the long term groundwater monitoring program will be submitted to an approved laboratory for lead analysis by USEPA Method 7420. During each sampling event a duplicate sample will be collected. If disposable or dedicated sampling equipment will be used to collect groundwater samples, a field blank will not be necessary.

5.4 Cap Maintenance

5.4.1 Mowing

During the long-term cap maintenance program, the cap will be mowed once per year near the end of the growing season to prevent the growth of shrubs, trees, and other deep-rooted vegetation, as well as for aesthetic purposes. Specific mowing frequencies and times will be established in the OMM Plan.

5.4.2 Inspections

Inspection of the cap will be performed by a site walk across and around the cap to visually review the entire surface. The inspector will look for abnormalities such as erosion damage, ponding water, settlement/subsidence, slumps/slides, and evidence of burrowing by wildlife.

The landfill inspection schedule will be as follows:

Years After Cap Completion	Frequency
0 - 1	Monthly
1 - 10	Quarterly
10 - 30	Annually

5.4.3 Cap Repairs

The cap repairs may include repairs to control erosion damage, ponding water, settlement/subsidence, slumps/slides, and evidence of burrowing by wildlife. In addition, damage to geomembrane and liners will be identified (if any), and appropriate maintenance/repairs will be performed, as necessary. Areas of erosion, settlement, and ponding water will be repaired by the placement of soil to correct and/or enhance drainage. Any damage caused by burrowing animals will be repaired by the placement of soil. If the problem persists, controls such as fencing, a barrier, or extermination may be used. Upon the placement of soil, repairs will be completed by reseeding and fertilizing, if necessary, to maintain a good vegetative cover.

5.4.4 Fence Inspections/Repairs

Fence inspections will be performed by a fencing contractor on a monthly basis during the long-term maintenance program. Repairs, if necessary, will be performed by the contractor immediately following the inspection.

5.5 Reporting

Letter reports will be prepared and submitted to the NYSDEC on an annual basis summarizing the cap inspection/repairs, fence inspection/repairs, and results of the groundwater monitoring program. The hydrogeologic data will be compiled and assessed to identify trends in data, if any. Any changes to the monitoring plan will be proposed in the annual report to the NYSDEC for review and approval.

5.6 Institutional Controls

Following completion of remedial construction at the site, the PRP Group will notify the NYSDEC regarding the progress of obtaining the deed restrictions and also document the efforts made to obtain the deed restrictions.

6. Future Submittals

Following selection of a remedial contractor by the PRP Group, the remedial contractor will be responsible for the following submittals to NYSDEC:

- Site Management and Operations Plan (SMOP): The SMOP will present the site management structure and describe the specific activities associated with implementation of the remedial action. Specifically, the SMOP will include:

  - Discussion on key project personnel and their roles and responsibilities, including the PRP Group, the Engineer, and the remedial contractor's site manager and foreman/supervisors;
  - Detailed project schedule;
  - Description of proposed method of excavation and consolidation of off-site soils, including the anticipated phasing of these activities;
  - Description of on-site maintenance activities; and
  - Description of approvals required (i.e., by Conrail, BSA).

Following NYSDEC approval of the SMOP, the remedial contractor will obtain the required access agreements and other approvals from Conrail and other local agencies.

- Health and Safety Plan: The remedial contractor's HASP will be submitted to the NYSDEC. It will be prepared to meet the minimum requirements presented in Appendix A.

- A letter identifying the borrow material source(s), and associated analytical data regarding the level of constituents of concern in the borrow materials.

In addition to submittals prior to the commencement of Site activities, the remedial contractor will be responsible for submittals to the NYSDEC during and following completion of remedial action activities. These submittals are anticipated to include:

- Monthly Progress Reports;
- Final Construction Certification Report; and
- Operations, Maintenance, & Monitoring Plan.

Tables

Table 1
Construction Cost Estimate
Bern Metal / Universal Site
Buffalo, New York

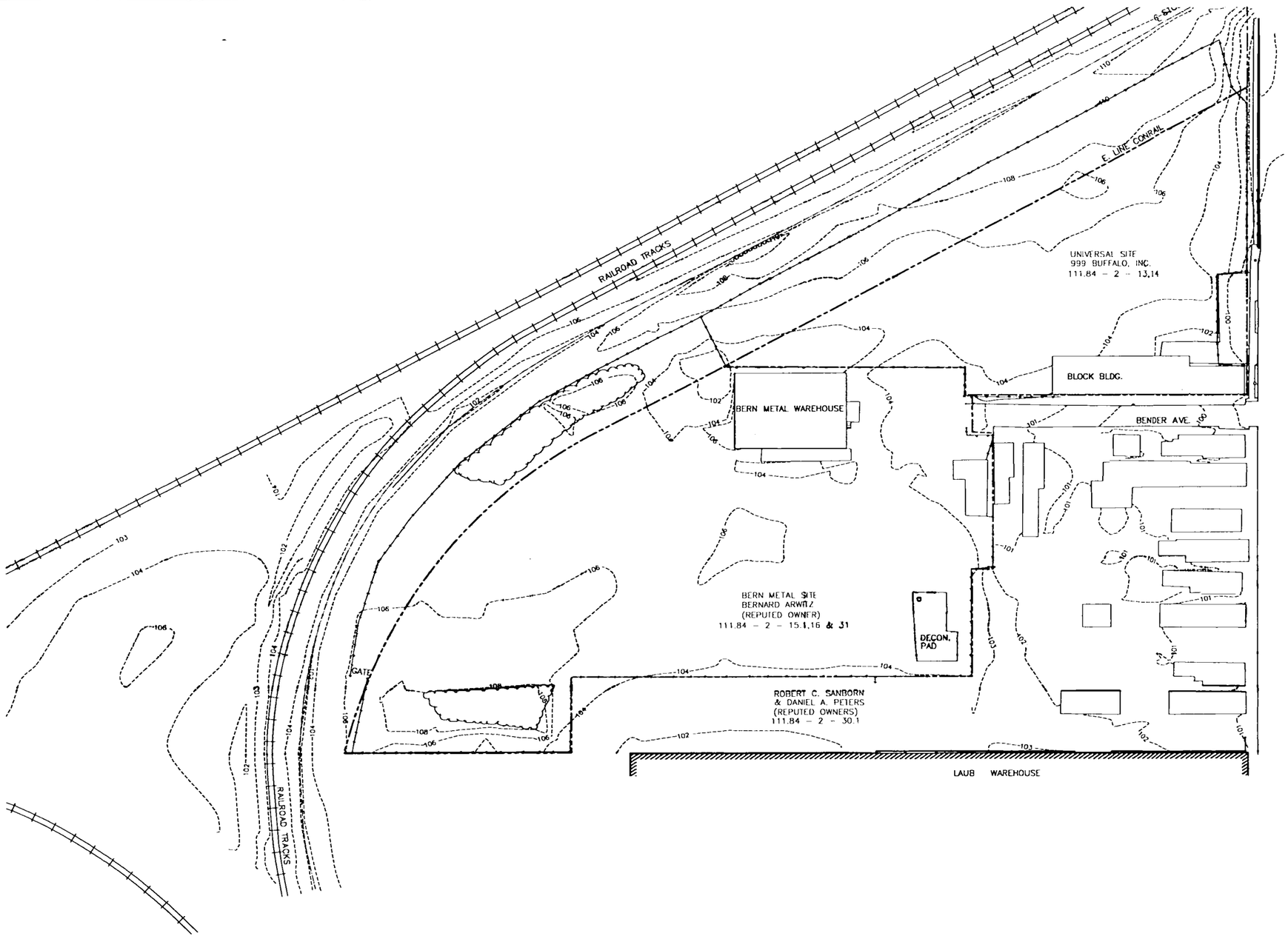
Item Number	Direct Costs Item	Unit	Unit Cost	Quantity	Years Incurred	Estimated Cost
A. Site Preparation						
1	Clearing/Grubbing	Acre	$2,800.00	7.70	1	$21,560
2	ConRail Access Road (Temporary)	SY	$3.20	7,330.00	1	$23,456
3	Erosion/Sedimentation Controls (Silt Fence)	LF	$1.00	7,700.00	1	$7,700
4	Existing Fence Remnoval	LF	$3.70	2,800.00	1	$10,360
5a	Fielod Trailers	Mo	$1,800.00	4.00	1	$7,200
5b	Utility Connections	LS	$5,000.00	1.00	1	$5,000
5t					Total =	$75,276
B. Site Remediation						
6	Structure Demolition (Buildings)	CF	$12.80	5,650.00	1	$72,320
7a	Excavation - ConRail South (incl. 10% overage)	CY	$6.90	4,765.00	1	$32,879
7b	Transport from ConRail South (incl. 25% swell)	CY	$9.00	5,960.00	1	$53,640
7c	Excavation - Universal/Laub/Crow	CY	$9.60	15,050.00	1	$144,480
7d	Transport - Universal/Laub/Crow (incl. 25% swell)	CY	$2.70	18,800.00	1	$50,760
7e	Backfill - Conrail South/Universal/Laub/Crow	CY	$11.77	24,760.00	1	$291,425
7f	Excavation - Bern Metal	CY	$15.00	230.00	1	$3,450
7g	Dust Control (water truck)	Day	$400.00	90.00	1	$36,000
7h	Decontamination	LS	$10,000.00	1.00	1	$10,000
8	Restoration (clearing/grubbing area plus 5%)	Ac	$1,800.00	8.10	1	$14,580
8t					Total =	$709,534
C. Cap Construction						
9	Fine Grading	SY	$0.45	13,000.00	1	$5,850
10	Anchor Trench Construction	LF	$2.00	810.00	1	$1,620
11	12 oz/sy Non-Woven Geotextile	SY	$0.50	14,834.00	1	$7,417
12	60-mil Textured HDPE Geomembrane	SF	$0.47	127,700.00	1	$60,019
13	Geosynthetic Drainage Composite	SF	$0.27	127,700.00	1	$34,479
14	12" Barrier Protection Layer - Place/Compact	CY	$9.42	4,482.00	1	$42,220
15	6" Topsoil Layer - Place/Compact	CY	$17.85	2,330.00	1	$41,591
16	Seeding Vegetative Cover	Ac	$1,800.00	2.70	1	$4,860
16t					Total =	$198,056
D. Stormwater/Erosion Control						
17	Outlet Drainage Ditch (incl. Rip Rap)	LF	$11.75	40.00	1	$470
18	Rip Rap Channel Protection	Ton	$15.00	25.00	1	$375
19	Mid-Slope Drainage Swale	LF	$63.00	110.00	1	$6,930
20	Perimeter Drainage Ditch	LF	$3.50	810.00	1	$2,835
21	Perimeter Drainage Stone	Ton	$12.00	30.00	1	$360
21t					Total =	$10,970
E. Air Monitoring						
22	Field Technician	Hr	$45.00	1,080.00	1	$48,600
23	Hi-Volume Sampling	Mo	$2,500.00	3.00	1	$7,500
24	Mini-Ram Rental	Mo	$4,000.00	3.00	1	$12,000
25	OVM Rental	Mo	$1,300.00	3.00	1	$3,900
26	Sample Analysis (21 Samples per week)	Wk	$2,500.00	3.00	1	$7,500
27	Health & Safety Oversight	Hr	$45.00	1,080.00	1	$48,600
27t					Total =	$128,100

Table 1 (cont.)
Construction Cost Estimate
Bern Metal / Universal Site
Buffalo, New York

F. Institutional Controls						
28	Site Fencing	LF	$17.35	810.00	1	$14,054
29	Swing Gate	Ea	$450.00	1.00	1	$450
30	Security Guard (16 hours per day)	Day	$160.00	120.00	1	$19,200
30t					**Total =**	**$33,704**
G. Mobilization/Demobilization						
31	Mobilization/Demobilization	LS	10 %	1.00	1	$115,564
31t					**Total =**	**$115,564**
H. Post Closure Maintenance (30 years @ 5% per year)						
Site Inspection and Maintenance						
32	Semi-Annual Site Inspection (Cover, Drainage and Fence)	Hr	$70.00	20.00	30	$21,522
33	Maintenance/Repair of Cover System Vegetation	Ea	$500.00	1.00	30	$7,686
34	Maintenance/Repair of Cover Soil	Ea	$500.00	1.00	30	$7,686
35	Maintenance/Repair of Drainage System	Ea	$750.00	1.00	30	$11,529
36	Maintenance/Repair of Fencing	Ea	$500.00	1.00	30	$7,686
37	Mowing	Ea	$245.00	4.00	30	$15,065
38	Debris cleanup and removal	Ea	$450.00	1.00	30	$6,918
39	Reporting	Ea	$500.00	2.00	30	$15,373
Groundwater Sampling						
40	Sampling Labor (years 1-10)	Ea	$995.00	2	2	$3,700
41	Sampling Labor (years 10-30)	Ea	$995.00	1	28	$11,595
42	Sampling Equipment and Expense (years 1-10)	Ea	$290.00	2	2	$1,078
43	Sampling Equipment and Expense (years 10-30)	Ea	$290.00	1	28	$3,380
44	Laboratory Analytical (years 1-10)	Ea	$175.00	2	2	$651
45	Laboratory Analytical (years 10-30)	Ea	$175.00	1	28	$2,039
46	Reporting (years 1-10)	Ea	$500.00	2	2	$1,859
47	Reporting (years 10-30)	Ea	$500.00	1	28	$5,827
47t					**Total =**	**$123,595**
					Sub-Total =	$1,394,798
					Contingency (25 %) =	$348,699
					Total =	$1,743,497

Notes:
1. All present worth costs are in 1998 US Dollars.
2. Present worth costs based on a 5% rate of return.
3. Assumes semi-annual sampling for years 1 and 2, followed by annual sampling for years 3 - 30.

Figures



LEGEND

- APPROXIMATE PROPERTY LINE LOCATION
- 104 EXISTING CONTOUR LINE
- EXISTING FENCE LINE (SEE NOTE 7)
- EXISTING RAILROAD TRACKS
- EXISTING VEGETATION

NOTES:

1. BASE MAP INFORMATION FOR THE BERN METAL SITE AND CLINTON STREET/BENDER AVENUE PROPERTIES WAS OBTAINED FROM A LAND SURVEY PERFORMED BY BLASLAND, BOUCK & LEE INC. DATED SEPTEMBER 1992. BASE MAP INFORMATION FOR THE UNIVERSAL SITE AND CONRAIL PROPERTY WAS OBTAINED FROM A SURVEY PERFORMED BY WENDEL SURVEY, DATED JULY 1994, AND MAY 1995.
2. SILT FENCE AND/OR STRAW BALES SHALL BE INSTALLED WHERE NECESSARY TO MINIMIZE THE POTENTIAL FOR SOIL EROSION. REFER TO DETAILS 3 AND 4 ON DRAWING NUMBER 7.
3. THE LOCATION OF UTILITIES AND STRUCTURES SHOWN ON THIS DRAWING ARE APPROXIMATE. OTHER UTILITIES AND STRUCTURES MAY EXIST, THE LOCATION OF WHICH ARE PRESENTLY UNKNOWN.
4. CONTRACTOR SHALL VERIFY THE PRESENCE AND LOCATION OF ABOVE GROUND AND UNDER GROUND SITE FEATURES IN THE VICINITY OF CONSTRUCTION ACTIVITIES PRIOR TO THE COMMENCEMENT OF SITE WORK.
5. INFORMATION REGARDING SITE SURVEY CONTROL WILL BE PROVIDED BY THE OWNER FOR CONTRACTOR USE PRIOR TO COMMENCEMENT OF SITE WORK. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY FOR ESTABLISHING AND MAINTAINING CONSTRUCTION SURVEY CONTROL AS REQUIRED DURING PERFORMANCE OF THE CONTRACT WORK.
6. EXISTING CONTOUR INTERVAL EQUALS 1 FOOT.
7. EXISTING FENCING TO BE REMOVED WHERE NECESSARY TO ALLOW ACCESS TO REMEDIAL CONSTRUCTION AREA. REMOVED FENCING SHALL BE REPLACED WITH EXISTING FENCE MATERIALS OR WITH NEW FENCING AS SPECIFIED IN DETAIL 5 ON DRAWING 7.

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Graphic Scale
50' 0 50' 100'
1"=50'

NO ALTERATIONS PERMITTED HEREON EXCEPT AS PROVIDED UNDER SECTION 7209 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW

No.	Date	Revisions	Init

Project Mgr. _____
Designed by _____
Drawn by _____
Checked by _____
Prof. Eng. _____
PE License _____

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

BERN METAL/UNIVERSAL SITE • BUFFALO, NEW YORK
REMEDIAL ACTION DESIGN REPORT

EXISTING SITE PLAN

GENERAL

File Number
778.03.XXF

Date
SEPTEMBER 1998

Blasland, Bouck & Lee, Inc.
Corporate Headquarters
6723 Towpath Road
Syracuse, NY 13214
315-446-9120

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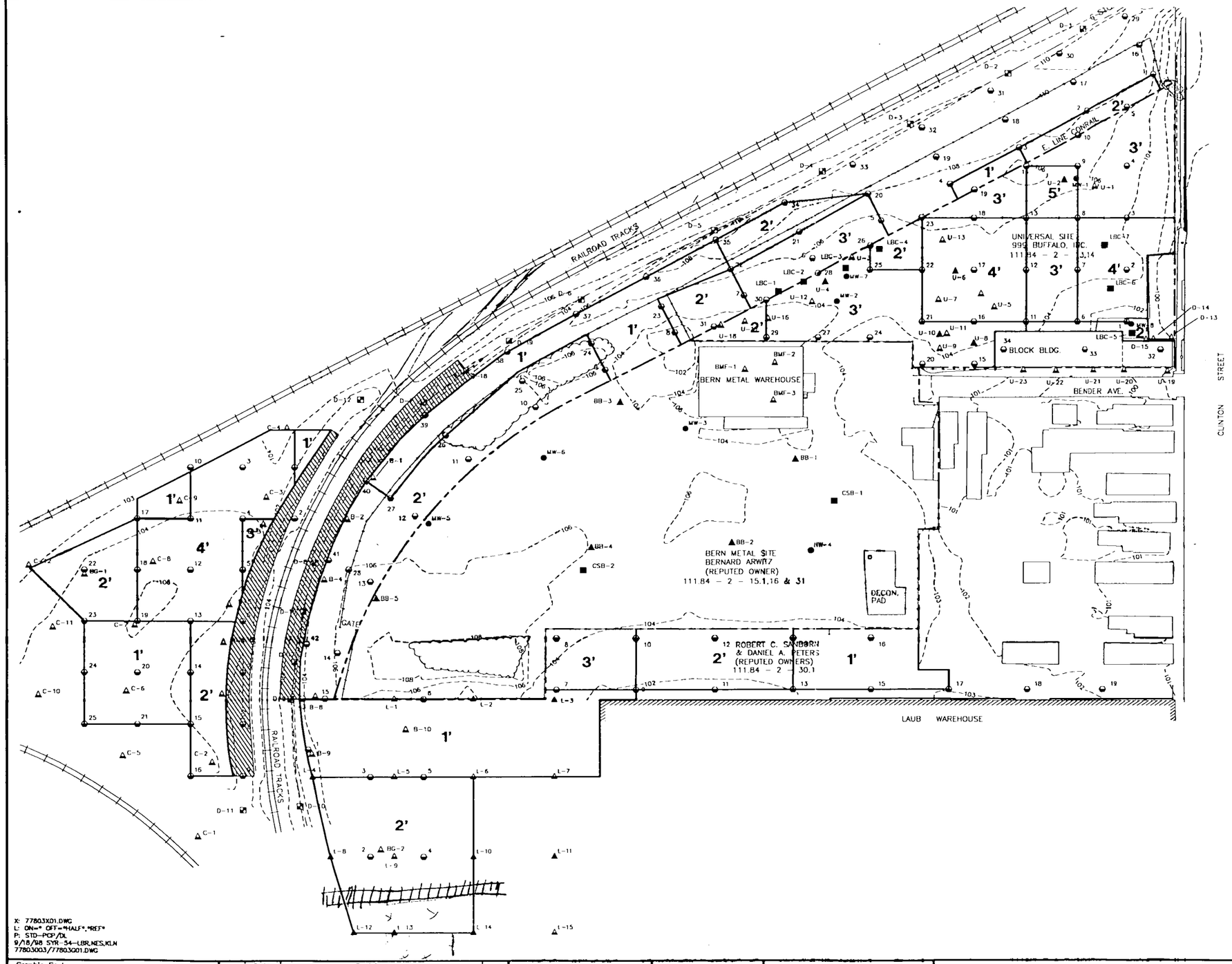

LEGEND

- APPROXIMATE PROPERTY LINE LOCATION
- PROPOSED EXCAVATION LIMITS (SEE NOTE 2)
- 3' ANTICIPATED DEPTH OF EXCAVATION
- PREVIOUS SEDIMENT SAMPLE
- PREVIOUS MONITORING WELL
- PREVIOUS SOIL BORING
- PREVIOUS GEOTECHNICAL BORING
- PREVIOUS SURFACE SAMPLE
- SOIL BORING CONDUCTED APRIL 1998
- SEDIMENT SAMPLE COLLECTED APRIL 1998
- DITCH SEDIMENT EXCAVATION (SEE NOTE 3)

NOTES:

1. REFER TO DRAWING NUMBER 1 FOR ADDITIONAL BASE MAP INFORMATION.
2. EXCAVATIONS WILL BE TO THE DEPTH SHOWN OR TO 6" BELOW TOP OF UNDERLYING CLAY LAYER, WHICHEVER IS ENCOUNTERED FIRST.
3. DITCH SEDIMENTS TO BE EXCAVATED TO A DEPTH OF 1 FOOT BELOW EXISTING GRADE. ALL EXCAVATION ACTIVITIES SHALL BE PERFORMED IN ACCORDANCE WITH SETBACK REQUIREMENTS ESTABLISHED BY CONRAIL.
4. EXCAVATIONS ADJACENT TO UNIVERSAL IRON & METAL BUILDING WILL BE PERFORMED IN A MANNER WHICH PROTECTS THE STRUCTURAL INTEGRITY OF THE BUILDING. AT **A MINIMUM, SOILS WILL BE EXCAVATED TO A DEPTH OF 18"** BELOW EXISTING GRADE IMMEDIATELY ADJACENT TO THE SOUTHERN AND WESTERN SIDES OF THE BUILDING. NO SOIL WILL BE EXCAVATED ALONG THE NORTHERN OR EASTERN SIDES OF THE BUILDING.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPLACEMENT OF RIP RAP AND BALLAST ALONG THOSE PORTIONS OF THE CONRAIL DITCHES TO BE EXCAVATED. NEW RIP RAP AND BALLAST PLACED IN THESE AREAS SHALL MEET CONRAIL SPECIFICATIONS. THE CONTRACTOR MAY REMOVE AND TEMPORARILY STAGE EXISTING RIP RAP AND BALLAST THAT IS NOT IN CONTACT WITH UNDERLYING SOILS/SEDIMENTS. EXISTING RIP RAP OR BALLAST THAT IS STAGED WILL BE REPLACED BY THE CONTRACTOR FOLLOWING EXCAVATION AND BACKFILLING OF THE DITCHES. ALL OTHER RIP RAP AND BALLAST REMOVED FROM THESE AREAS SHALL BE CONSOLIDATED ONTO THE BERN METAL PROPERTY.

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Graphic Scale
50' 0 50' 100'
1"=50'

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No.	Date	Revisions	Init

Project Mgr.
Designed by
Drawn by
Checked by
Prof. Eng.
PE License

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

BERN METAL/UNIVERSAL SITE • BUFFALO, NEW YORK
REMEDIAL ACTION DESIGN REPORT

EXCAVATION PLAN

GENERAL

File Number
FILE NO.

Date
SEPTEMBER 1998

Blasland, Bouck & Lee, Inc.
Corporate Headquarters
6723 Towpath Road
Syracuse, NY 13214
315-446-9120

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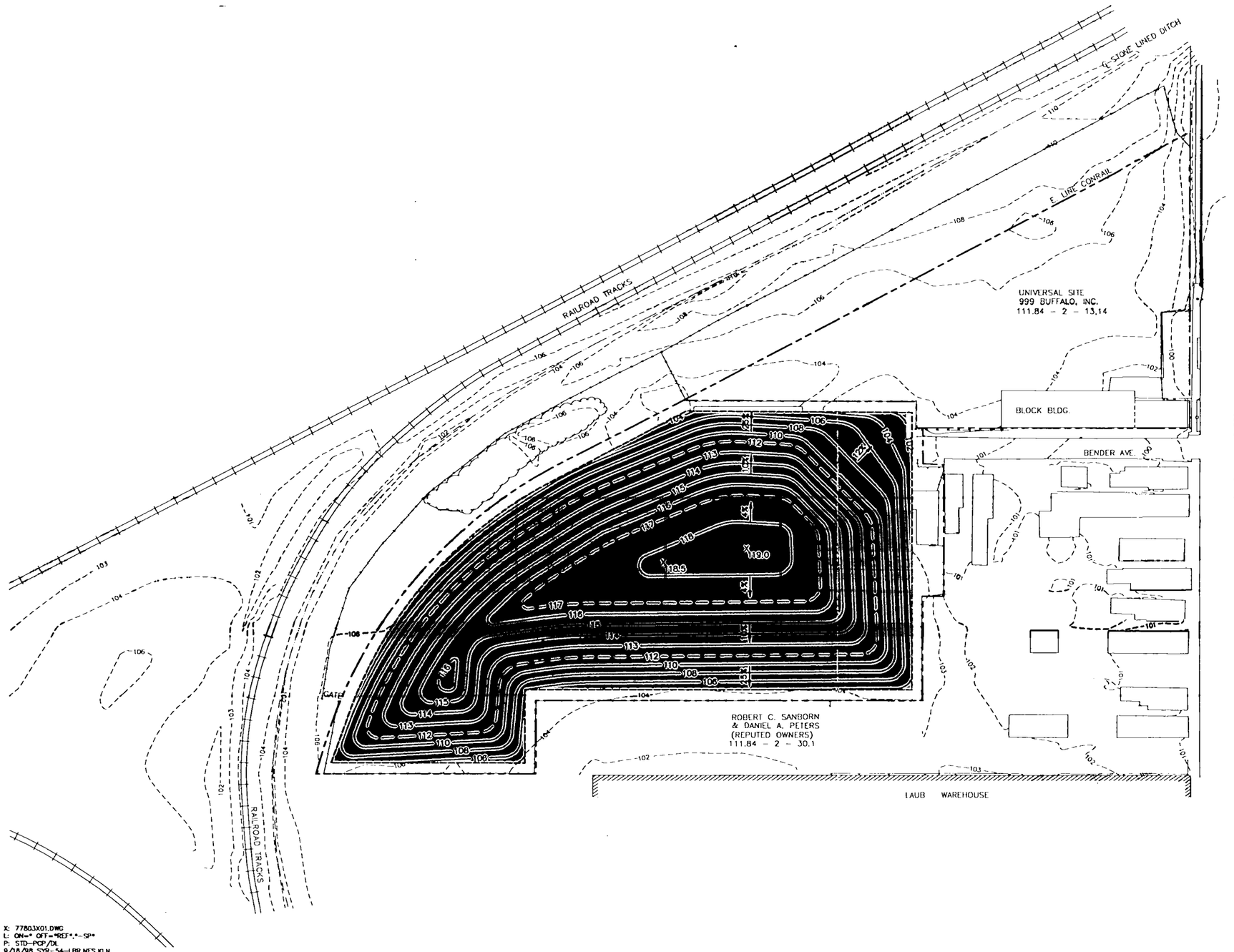

LEGEND

- APPROXIMATE PROPERTY LINE LOCATION
- APPROXIMATE AREA OF PROPOSED SUBGRADE GRADING
- 120 — PROPOSED ELEVATION CONTOUR LINE
- X 119.0 — PROPOSED SPOT ELEVATION
- PROPOSED CHANGE-IN-GRADE
- PROPOSED COVER SYSTEM ANCHOR TRENCH (2/6)

NOTES:

1. REFER TO DRAWING NUMBER 1 FOR ADDITIONAL BASE MAP INFORMATION.
2. PROPOSED CONTOUR INTERVAL EQUALS 1-FOOT AND **2-FOOT.**
3. PROPOSED GRADES REPRESENT TOP OF SUBGRADE (BOTTOM OF COVER SYSTEM) ACTUALLY CONSTRUCTED. GRADES MAY VARY AS A RESULT OF FINAL EXCAVATION LIMITS AND VOLUMES. MINIMUM COVER SYSTEM SLOPES SHALL BE NO LESS THAN 4%. MAXIMUM COVER SYSTEM SLOPES SHALL BE NO GREATER THAN 33%.
4. TO THE EXTENT POSSIBLE, SURFACE DEBRIS AND VEGETATION SHALL BE SHREDDED AND PLACED WITHIN THE LIMITS OF THE PROPOSED COVER SYSTEM. ITEMS THAT CANNOT BE ACCOMMODATED SHALL BE SEGREGATED FOR OFF-SITE DISPOSAL.
5. CONSTRUCTION ACTIVITIES SHALL BE PERFORMED TO AVOID DAMAGE TO EXISTING FACILITIES OUTSIDE OF THE PROPOSED COVER SYSTEM.
6. GRADING OF EXISTING MATERIALS WITHIN THE LIMITS OF THE PROPOSED COVER SYSTEM SHALL BE PERFORMED IN A MANNER WHICH MINIMIZES THEIR DISTURBANCE AND PREVENTS MOVEMENT OF THESE MATERIALS OUTSIDE OF THE PROPOSED COVER SYSTEM.

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77803003/77803003.DWG

Graphic Scale
50' 0 50' 100'
1"=50'

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Project Mgr.
Designed by
Drawn by
Checked by
Prof. Eng.
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REMEDIAL ACTION DESIGN REPORT

SUBGRADE GRADING PLAN

GENERAL

File Number
FILE NO.

Date
SEPTEMBER 1998

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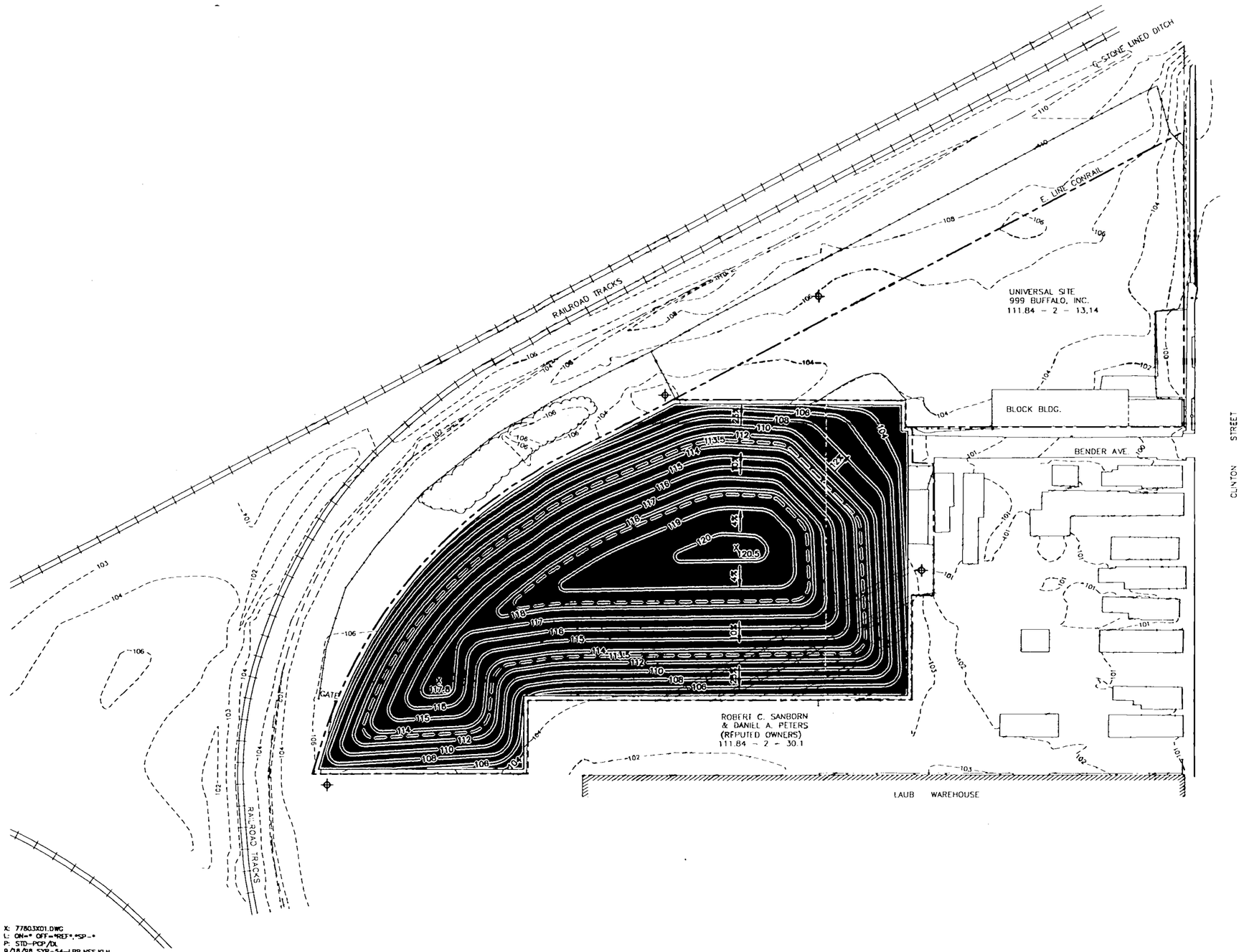
315-446-9120

3



LEGEND

- APPROXIMATE PROPERTY LINE LOCATION
- APPROXIMATE AREA OF PROPOSED COVER SYSTEM (1/6)
- 120 — PROPOSED ELEVATION CONTOUR LINE
- X 120.5 — PROPOSED SPOT ELEVATION
- PROPOSED CHANGE-IN-GRADE
- PROPOSED MONITORING WELL LOCATIONS

NOTES:

1. REFER TO DRAWING NUMBER 1 FOR ADDITIONAL BASE MAP INFORMATION.
2. PROPOSED CONTOUR INTERVAL EQUALS 1 FOOT AND 2 FOOT.
3. PROPOSED GRADES REPRESENT FINAL GRADE (TOP OF COVER SYSTEM). GRADES MAY VARY AS A RESULT OF FINAL EXCAVATION LIMITS AND VOLUMES. MINIMUM COVER SYSTEM SLOPES SHALL BE NO LESS THAN 4%. MAXIMUM COVER SYSTEM SLOPES SHALL BE NO MORE THAN 33%.
4. REFER TO DRAWING NUMBER 5 FOR STORMWATER MANAGEMENT INFORMATION.

X: 77803X01.DWG
L: ON=* OFF=*REF*,*SP-*
P: STD-PCP/DL
9/18/98 SYR-54-LBR,NES,KLN
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Graphic Scale
50' 0 50' 100'
1"=50'

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FINAL GRADING PLAN

GENERAL

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FILE NO.

Date
SEPTEMBER 1998

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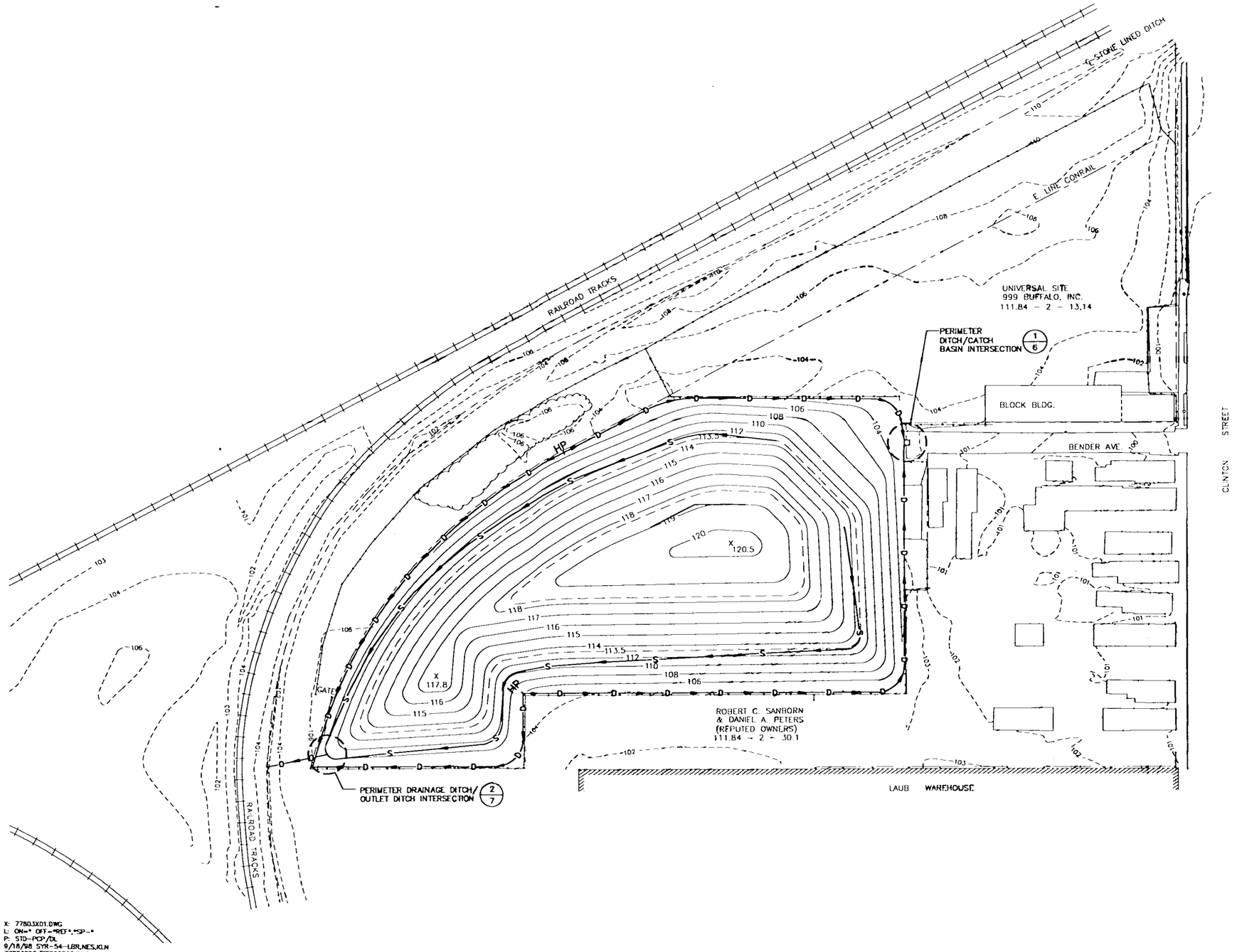

LEGEND

- APPROXIMATE PROPERTY LINE LOCATION
- 120 — PROPOSED ELEVATION CONTOUR LINE
- X 120.5 — **PROPOSED SPOT ELEVATION**
- PROPOSED CHANGE-IN-GRADE
- —S— PROPOSED MIDSLOPE DRAINAGE SWALE (SEE NOTE 3) 3/6
- —D— PROPOSED PERIMETER DITCH (SEE NOTE 4) 2/6
- —O—O— PROPOSED OUTLET DRAINAGE DITCH (SEE NOTE 5) 4/6
- HP PROPOSED HIGH POINT

NOTES:

1. REFER TO DRAWING NUMBER 1 FOR ADDITIONAL BASE MAP INFORMATION.
2. REFER TO DRAWING NUMBER 4 FOR ADDITIONAL FINAL GRADING INFORMATION.
3. MID-SLOPE DRAINAGE SWALE SHALL BE CONSTRUCTED WITH A 1% MINIMUM INVERT SLOPE.
4. PERIMETER DRAINAGE DITCH SHALL BE CONSTRUCTED WITH A 0.5% MINIMUM INVERT SLOPE.
5. OUTLET DRAINAGE DITCH SHALL BE CONSTRUCTED WITH A 1% MINIMUM INVERT SLOPE.

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P: STD-PCP/DL
9/18/98 STR-54-LEBLANES.XLN
77803003/77803005.DWG

Graphic Scale
50' 0 50' 100'
1"=50'

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STORMWATER MANAGEMENT PLAN

GENERAL

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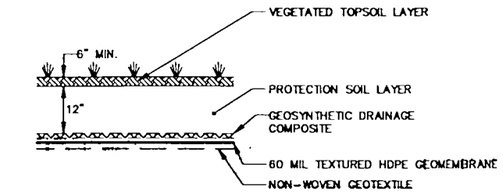
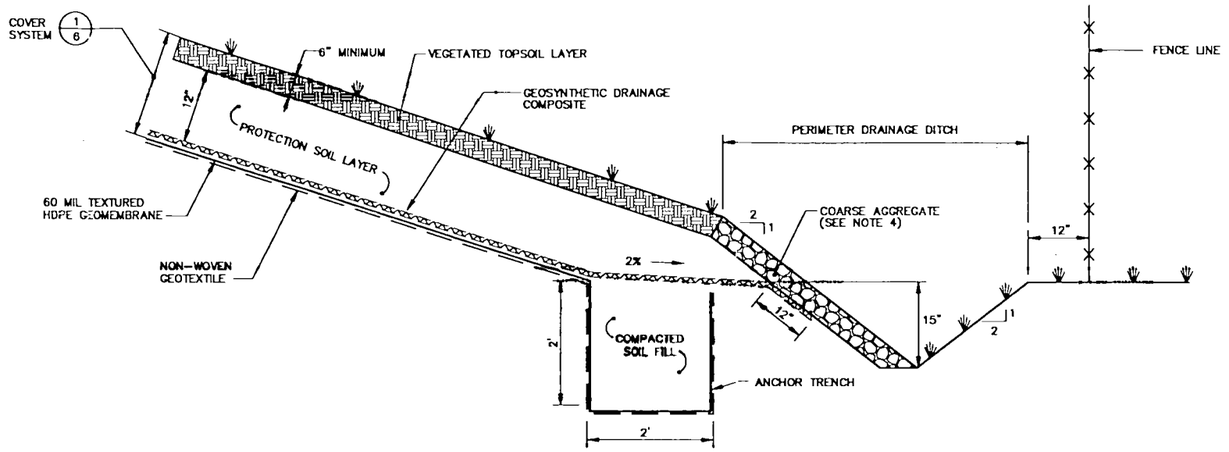


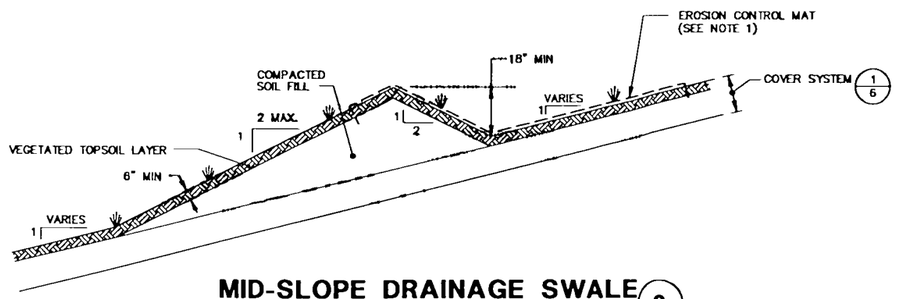
COVER SYSTEM 1

NOT TO SCALE



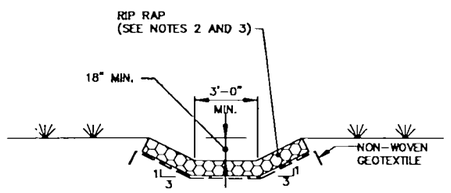
ANCHOR TRENCH/PERIMETER DRAINAGE DITCH 2

NOT TO SCALE



MID-SLOPE DRAINAGE SWALE 3

NOT TO SCALE



OUTLET DRAINAGE DITCH 4

NOT TO SCALE

NOTES:

1. EROSION CONTROL MAT SHALL BE NORTH AMERICAN GREEN SC150 OR EQUAL. EROSION CONTROL MAT SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS.
2. RIP RAP SHALL CONSIST OF CRUSHED STONE FREE FROM DELETERIOUS MATERIALS AND HAVE D_{50} = 6", AND D_{MAX} = 8".
3. ALL RIP RAP SHALL BE PLACED SECURELY IN A MANNER WHICH MINIMIZES VOID SPACES.
4. COARSE AGGREGATE SHALL BE NYSDOT 703-2 (4A) COARSE AGGREGATE.

X: NONE
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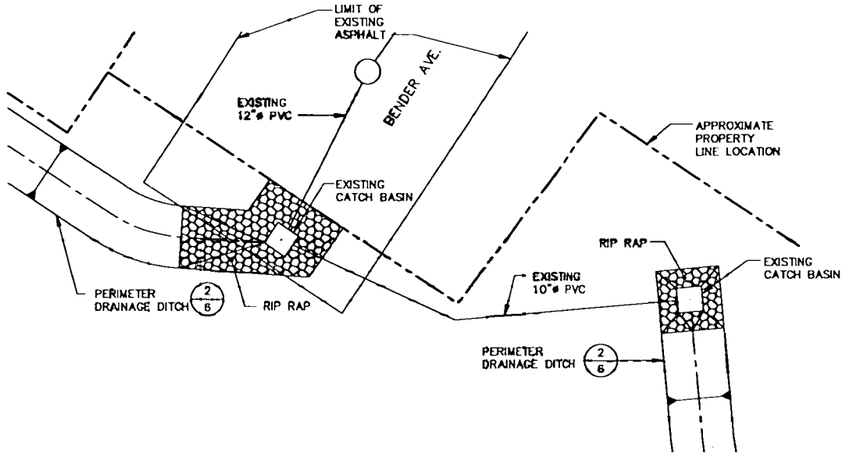
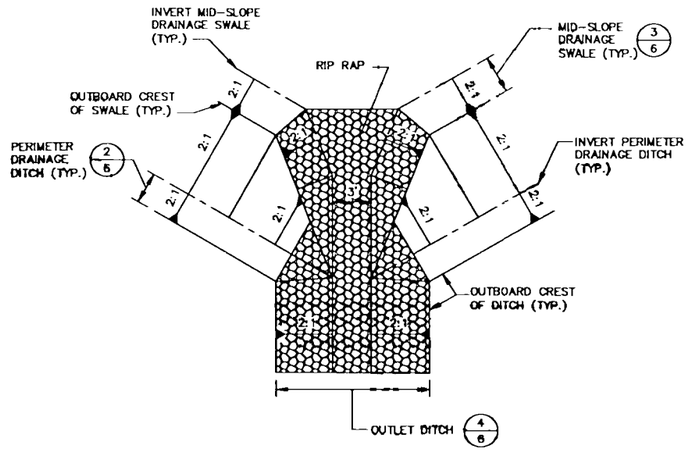


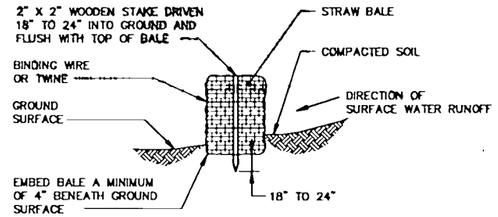
PERIMETER DRAINAGE DITCH/ CATCH BASIN INTERSECTION (1)

NOT TO SCALE



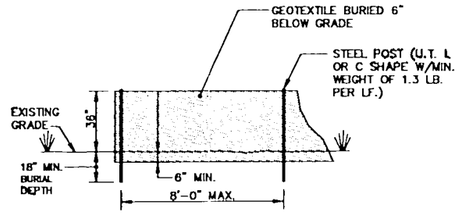
PERIMETER DRAINAGE DITCH/ OUTLET DITCH INTERSECTION (2)

NOT TO SCALE



STRAW BALE (3)

NOT TO SCALE

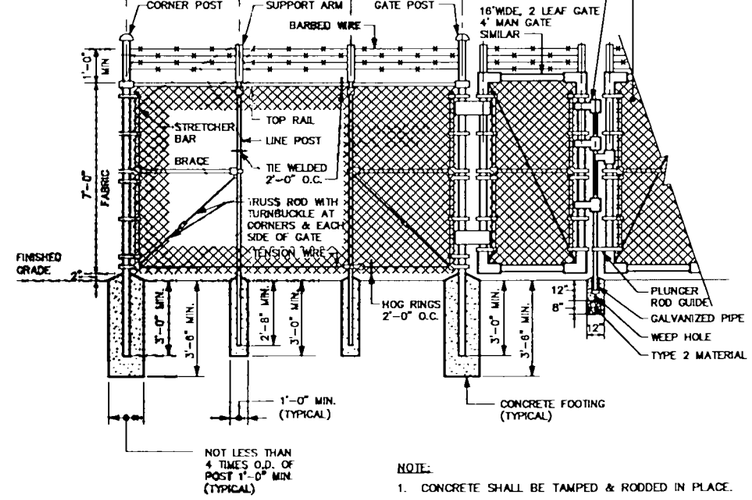


NOTES:

1. SEDIMENT DEPOSITS WILL BE REMOVED WHEN DEPOSIT ACCUMULATIONS REACH APPROXIMATELY 6-INCHES ABOVE GRADE OR AS DIRECTED BY THE ENGINEER.
2. THE SILT FENCE WILL REMAIN IN PLACE UNTIL THE ENGINEER DIRECTS THAT IT WILL BE REMOVED. UPON REMOVAL, THE CONTRACTOR WILL REMOVE AND PROPERLY DISPOSE OF ACCUMULATED SEDIMENT AND VEGETATE ALL BARE AREAS IN ACCORDANCE WITH CONTRACT REQUIREMENTS.
3. CONTRACTOR SHALL BE RESPONSIBLE FOR CONTROLLING SEDIMENT MIGRATION AND MAINTAINING INTEGRITY OF SILT FENCE.

TEMPORARY SILT FENCE (4)

NOT TO SCALE



NOTE:

1. CONCRETE SHALL BE TAMPED & RODDED IN PLACE.

TYPICAL CHAIN LINK FENCE (5)

NOT TO SCALE

X: NONE
L: ON=* OFF=*REF*
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77803003/77803C07.DWG

NOT TO SCALE

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MATERIALS AND PERFORMANCE - SECTION 02219

GEOSYNTHETIC DRAINAGE COMPOSITE

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall provide all labor, materials, tools and equipment necessary to furnish and install geosynthetic drainage composite on the cover system as specified in the Design Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section MP-02234 - Geomembrane

1.03 REFERENCES

A. American Society of Testing and Materials (ASTM);

1.	D1505-85	Density Gravity Test
2.	D1238-88	Flow Rates of Thermoplastics by Extrusion Plastometer
3.	D1603	Carbon Black Content Test
4.	D374	Thickness
5.	D4716-87	Constant Head Transmissivity
6.	D3776	Weight
7.	D1777	Thickness
8.	D4632	Tensile Properties
9.	D3786	Mullen Burst
10.	D4833	Puncture
11.	D4751	A.O.S.
12.	D4533	Trapezoidal Tear

1.04 SUBMITTALS

A. Operational Submittals

1. Manufacturers data for the geosynthetic drainage composite including physical properties and roll size.

2. Geosynthetic drainage composite material sample.

3. Manufacturer's quality assurance/quality control program.

4. Certified results of all quality control testing.

5. Contractor's proposed transportation, handling and storage techniques.

MATERIALS AND PERFORMANCE - SECTION 02219

GEOSYNTHETIC DRAINAGE COMPOSITE

6. Shop drawings, and proposed installation techniques.

PART 2 - PRODUCT

2.01 ACCEPTABLE MANUFACTURERS

A. Tenax Corp.,
B. GSE Fabrinet, or
C. Approved equal.

2.02 MATERIALS

A. The geosynthetic drainage composite shall be comprised of a high density polyethylene (HDPE) drainage net composited with (2), 6 oz/yd^2 non-woven geotextile - geotextile heat bonded to both sides of the drainage net.

1. The drainage net to be utilized in the composite shall be a profiled mesh made by extruding two sets of high density strands together to form a diamond shaped, three-dimensional net to provide planar fluid flow. The drainage net shall be made of HDPE containing carbon black, anti-oxidants and heat stabilizers which shall be manufactured from resin provided from one resin supplier.

2. The geotextile shall be a non-woven, needle punched polymeric material.

B. The geosynthetic drainage composite shall meet the following minimum specifications:

1. Drainage Net

Property	Test Method	Test Value
Specific Gravity (g/cm^3)	ASTM D1505	0.94
Tensile Strength (lb/in)	ASTM D5034/5035	45
Percent Carbon Black (%)	ASTM D1603	2.0
Transmisivity (m^2/sec)	ASTM D4716	1 x 10^{-3}
Thickness (mil)	ASTM D374 at Strand Intersection	200 - 275

MATERIALS AND PERFORMANCE - SECTION 02219

GEOSYNTHETIC DRAINAGE COMPOSITE

2. Geotextile

Property	Test Method	Test Value
Fabric Weight (oz/yd^2)	ASTM D-3776	6
Thickness (mils)	ASTM D-1777	70
Grab Strength (lbs.)	ASTM D-4632	150
Puncture (lbs.)	ASTM D-4833	110
A.O.S. (U.S. Sieve)	ASTM D-4751	70
Permittivity (gal/min/ft^2/sec^{-1})	ASTM D-4491	110/1.6
Permeability (cm/sec)	ASTM D-4491	.2

2.03 DELIVERY, STORAGE AND HANDLING

A. The geosynthetic drainage composite shall be packaged and shipped by appropriate means so as to prevent damage. Materials shall be delivered only after the required submittals have been received and reviewed by the Engineer.

B. The geosynthetic drainage composite shall be furnished in rolls and be marked or tagged with the following information:

1. Manufacturer's Name
2. Product Identification
3. Lot/Batch Number
4. Roll Number
5. Roll Dimensions

C. The geosynthetic drainage composite shall be stored in an area which prevents damage to the product or packaging.

D. The geosynthetic drainage composite shall be kept clean and free from dirt, dust, mud and other debris.

E. Any geosynthetic drainage composite found to be damaged shall be replaced with new material at the Contractor's expense.

MATERIALS AND PERFORMANCE - SECTION 02219

GEOSYNTHETIC DRAINAGE COMPOSITE

2.04 QUALITY ASSURANCE

A. Field delivered material shall meet the specifications values according to the manufacturer's specification sheet. The Contractor shall submit written certification that the delivered material meets the manufacturer's specifications. The Contractor shall submit to the Engineer certified quality control test results conducted by the manufacturer during the manufacturing of the geosynthetic drainage composite delivered to the project site. The results must identify the sections of field delivered geosynthetic drainage composite they represent.

B. The manufacturer shall have developed and shall adhere to their own quality assurance program in the manufacture of the geosynthetic drainage composite.

C. The installer shall verify in writing prior to installation that the geosynthetic drainage composite has not been damaged due to improper handling or storage.

D. Each of the installer's personnel shall have recorded 500,000 sf of successful material installation.

E. The Contractor shall provide shop drawings for indicating panel layouts and installation sequence.

PART 3 - EXECUTION

3.01 PREPARATION

A. The areas designated for placement of geosynthetic drainage composite shall be free from any deleterious material.

B. If the geosynthetic drainage composite is not clean before installation, it shall be washed by the Contractor until accepted by the Engineer.

3.02 INSTALLATION

A. Geosynthetic drainage composite shall be installed at locations described on the Design Drawings.

B. Adjacent rolls shall be overlapped 2 inches along the roll length and 6 inches across the roll width, or as specified by the Engineer.

C. In the corners of the side slopes, where overlaps between rolls of nets are staggered, an extra layer of geosynthetic drainage composite shall be installed from the top to the bottom of the slope.

MATERIALS AND PERFORMANCE - SECTION 02219

GEOSYNTHETIC DRAINAGE COMPOSITE

D. The geosynthetic drainage composite shall be unrolled downslope keeping the net in slight tension to minimize wrinkles and folds.

E. Adequate loading shall be placed to prevent uplift by wind.

F. Holes or tears in the geosynthetic drainage composite shall be repaired in accordance with the manufacturere's recommendations.

G. Adjacent rolls shall be joined by tying the drainage net together with white or yellow plastic fasteners or polymeric braid. These ties shall be placed every 5 feet along the roll length and every 1 foot across the rollwidth and every 6 inches in the anchor trench or as specified by the Engineer.

H. Overlapped geotextile shall be secured by heat bonding or stitching as specified by the Engineer. Care must be taken to avoid burning throughout the geotextile if heat bonding is to be used. A minimum single stitch "flat" or "prayer" seam is recommended if stitching of geotextile is to be used.

3.03 QUALITY CONTROL

A. The Contractor shall provide as-built drawings identifying panel layout, locations of imperfections, repairs, and any other appropriate observations.

B. The Contractor shall obtain and submit to the Owner from the manufacturer a standard warranty against defects in workmanship and material. The Engineer will review the warranty for completeness prior to the Owner accepting its provisions.

- END OF SECTION -

MATERIALS AND PERFORMANCE - SECTION 02232

GEOTEXTILE

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Contractor shall supply all labor, materials, tools, and equipment required to furnish and install woven and non-woven geotextile fabric as specified herein and as shown on the Design Drawings.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. ASTM D3776 Unit Weight
2. ASTM D4632 Grab Tensile
3. ASTM D4632 Grab Elongation
4. ASTM D3786 Mullen Burst
5. ASTM D4833 Puncture
6. ASTM D4533 Trapezoid Tear
7. ASTM D4751 Apparent Opening Size
8. ASTM D4491 Permittivity
9. ASTM D1777 Thickness

1.03 SUBMITTALS

A. Manufacturer's data for geotextile including, at a minimum, physical properties, and packaging.

B. Manufacturer's quality assurance/quality control program.

C. Certified results of all quality control testing.

PART 2 - PRODUCT

2.01 ACCEPTABLE MANUFACTURERS

A. Synthetics Industries,
B. Amoco, or
C. Approved equal.

2.02 MATERIALS

A. For the purpose of these specifications, the terms "geotextile", "geotextile fabric", and "filter fabric" shall be considered synonymous.

MATERIALS AND PERFORMANCE - SECTION 02232

GEOTEXTILE

B. Geotextile fabric used shall be of the types listed below:

- Non-woven geotextile

C. The non-woven geotextile shall be of needle-punched construction and consist of long-chain polymeric fibers or filaments composed of polypropylene; shall be free of any chemical treatment which reduces permeability and shall be inert to chemicals commonly found in soil.

D. The non-woven geotextiles indicated on the Design Drawings shall have the minimum physical properties listed below:

Non-Woven Geotextile

Property	Unit of Measure	Test Method	Minimum Test Value
Unit Weight	oz./yd.^{2}	ASTM D3776	10
Grab Tensile	lbs.	ASTM D4632	250
Grab Elongation	%	ASTM D4632	50
Mullen Burst	psi	ASTM D3786	510
Puncture	lbs	ASTM D4833	160
Trapezoid Tear	lbs	ASTM D4533	100
Apparent Opening Size	US Sieve Number	ASTM D4751	100
Permittivity	sec^{-1}	ASTM D4491	1.2

2.03 DELIVERY, STORAGE AND HANDLING

A. The geotextile shall be furnished in a protective wrapping which shall be labeled with the following information: manufacturer's name, product identification, lot #, roll #, and dimensions.

B. The geotextile shall be protected from ultraviolet light, precipitation, mud, soil, excessive dust, puncture, cutting and/or other damaging conditions prior to and during delivery. The geotextile shall be capable of withstanding 30 days of sunlight without measurable deterioration. The geotextile shall be stored on-site at a location approved by the Engineer.

C. Rolls of material shall be stored on prepared surfaces (not pallets) and should not be stored more than two rolls high.

MATERIALS AND PERFORMANCE - SECTION 02232

GEOTEXTILE

D. During shipment and storage, protect from ultraviolet light exposure, precipitation or other inundation, mud, dirt, dust, puncture, cutting, or other damaging or deleterious conditions. Ship and store in relatively opaque and water tight wrapping.

E. Geocomposites and geomembranes shall not be exposed to sunlight for more than 15 days unless otherwise specified or guaranteed by the manufacturer.

F. Deliver HDPE geomembrane material to site only after the approval of panel layout submittal.

G. Geocomposites and geomembrane damage will be documented. Repair damaged materials, if possible, or replace at no additional cost.

2.04 QUALITY ASSURANCE

A. The field delivered material shall meet the specification values according to the manufacturer's specification sheet. The Contractor shall submit written certification that the delivered material meets the manufacturer's specifications. The Contractor shall provide the quality control test results conducted by the manufacturer during the manufacturing of the geotextile fabric delivered to the project site. The results shall identify the sections/panels of field delivered fabric they represent. The Contractor shall also provide the lot and roll number for the material delivered to the site.

B. The manufacturer shall have developed and shall adhere to its own quality assurance program in the manufacture of the geotextile.

C. The installer shall verify in writing prior to installation that the geotextile fabric has not been damaged due to improper handling of storage.

PART 3 - EXECUTION

3.01 PREPARATION

A. Prior to installation of the geotextile, subgrade surfaces shall be leveled and uniformly compacted, as necessary, to provide a smooth, stable interface for the geotextile.

3.02 GEOTEXTILE INSTALLATION

The following procedures and requirements will be followed during the installation of geotextile.

A. Placement

1. The placement of the geotextile shall not be conducted during adverse weather conditions. The geotextile will be kept dry during storage and up to the time of deployment. During windy conditions, all geotextiles will be secured with

sandbags or an equivalent approved anchoring system. Removal of the sandbags or equal will only occur upon placement of an overlying soil layer.

2. Proper cutting tools shall be used to cut and size the geotextile materials. Extreme care will be taken while cutting in-place geotextiles.

3. During placement of the geotextiles, all dirt, dust, sand, and mud shall be kept off to prevent clogging. If excessive contaminant materials are present on the geotextiles, it shall be cleaned or replaced as directed by the Engineer.

4. The geotextile shall be covered within the time period recommended by the manufacturer, and in no case later than two weeks after its placement.

B. Seaming or Joining

1. Geotextiles shall be seamed using either a 12-inch overlap or by sewing. The specific conditions requiring a sewn seam or simply an overlap are as follows:

   a. In all cases, seams on side slopes will be parallel to the line of slope and sewn 5 feet from the toe-of-slope upward over the length of the slope and into the anchor trench. No horizontal seams will be allowed on side slopes, except for patching.

   b. Where seaming cannot be conducted using sewing and where overlap is not appropriate, heat seaming may be permitted with the approval of the Engineer.

2. Sewing will be done using a polymeric thread with chemical compatibility resistance equal to or exceeding the geotextile being sewn. Thread and the sewing device shall be approved by the Engineer prior to its use in the field.

3. Repair of tears or holes in the geotextile will require the following procedures:

   a. On slopes: A patch made from the same geotextile will be double seamed into place; with each seam 1/4-inch to 3/4-inch apart and no closer than 1 inch from any edge. Should any tear exceed 10% of the width of the roll, that roll will be removed from the slope and replaced.

   b. Non-slopes: A patch made from the same geotextile will be spot-seamed in place with a minimum of 24 inch overlap in all directions.

3.03 POST-CONSTRUCTION

A. Upon completion of the installation, the Contractor shall submit to the Engineer.

MATERIALS AND PERFORMANCE - SECTION 02232

GEOTEXTILE

1. All quality control documentation and as-built panel drawings.
2. The warranty obtained from the Manufacturer/Fabricator.

3.04 WARRANTY

A. The Contractor shall obtain and submit to the Owner from the manufacturer a standard warranty provided for the geotextiles. The Engineer will review the warranty for completeness prior to the Owner accepting its provisions.

- END OF SECTION -

MATERIALS AND PERFORMANCE - SECTION 02212

TOPSOIL, SEEDING AND MULCH

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Work under this section consists of furnishing and placement of topsoil, fertilizer, seed, and mulch as shown on the Design Drawings, as specified herein and/or as directed.

B. Maintenance of seeded areas until final acceptance.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. MP-Section 02200 - Earthwork

1.03 SUBMITTALS

A. Analysis of the seed (to demonstrate compliance with the seed mix identified in Section 2.01 of this specification) and fertilizer (to identify chemical composition), and proposed application rates.

B. Should hydroseeder be used, the Contractor shall submit all data including material and application rates.

C. Location of source, and pH and organic content testing of off-site topsoil.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Any off-site topsoil shall be unfrozen, friable, natural loam and shall be free of clay lumps, brush, weeds, litter, stumps, stones, and other extraneous matter. The topsoil shall have an organic content between 5 and 20 percent, and a pH between 5.5 and 7.5.

B. All topsoil material shall be free from detectable levels of target compound list organic chemical contaminants and shall not have target analyte list inorganics at concentrations which exceed existing background levels. Topsoil material shall be certified clean by the Supplier.

C. Fertilizer shall be a standard quality commercial carrier of available plant food elements. A complete prepared and packaged material containing a minimum of 5 percent nitrogen, 10 percent phosphoric acid and 10 percent potash.

1. Each bag of fertilizer shall bear the manufacturer's guaranteed statement of analysis.

MATERIALS AND PERFORMANCE - SECTION 02212

TOPSOIL, SEEDING AND MULCH

D. Seed mixtures shall be of commercial stock of the current season's crop and shall be delivered in unopened containers bearing the guaranteed analysis of the mix.

1. All seed shall meet the State standards of germination and purity.

E. Seed mix shall be as follows:

65% fine fescue
15% perenial rye grass
20% Kentucky blue grass

F. Mulch shall be stalks of oats, wheat, rye or other approved crops free from noxious weeds and coarse materials.

PART 3 - EXECUTION

3.01 INSTALLATION

A. In the area to receive topsoil, all debris and inorganic material shall be removed and the surface loosened for a depth of 2 inches prior to the placing of the topsoil.

B. The topsoil shall not be placed until the subgrade is in suitable condition and shall be free of excessive moisture and frost.

C. The topsoil shall be applied in a single loose lift of not less than six-inches within the limits of the final cover system and not less than 4-inches for all other areas requiring topsoil. No compaction of topsoil material is required.

1. Following placement of topsoil and prior to fertilizer application, all over sized stones, sticks, and other deleterious material shall be removed.

D. The fertilizer shall be applied to the surface uniformly at the rate of 20 pounds per 1,000 square feet.

1. Following the application of the fertilizer and prior to application of the seed, the topsoil shall be scarified to a depth of at least 2 inches with a disk or other suitable method traveling across the slope if possible.

E. After the soil surface has been fine graded, the seed mixture shall be uniformly applied upon the prepared surface with a mechanical spreader at a rate specified by the seed manufacturer.

MATERIALS AND PERFORMANCE - SECTION 02212

TOPSOIL, SEEDING AND MULCH

1. The seed shall be raked lightly into the surface.

2. Seeding and mulching shall not be done during windy weather.

F. The mulch shall be hand or machine spread to form a continuous blanket over the seed bed, approximately 2 inches in uniform thickness at loose measurement with a minimum of 90% surface coverage. Excessive amounts or bunching of mulch shall not be permitted.

1. Mulch shall be anchored by an acceptable method.

2. Unless otherwise specified, mulch shall be left in place and allowed to decompose.

3. Any anchorage or mulch that has not disintegrated at time of first mowing shall be removed. For peg-type anchors, anchors may be removed or driven flush with ground surface.

G. Seeded areas shall be watered as often as required to obtain germination and to obtain and maintain a satisfactory sod growth. Watering shall be in such a manner as to prevent washing out of seed and mulch.

H. Hydroseeding may be accepted as an alternative method of applying fertilizer, seed and mulch. The Contractor must submit all data regarding materials and application rates to the Engineer for review.

3.02 MAINTENANCE

A. All erosion rills or gullies within the topsoil layer shall be filled with additional topsoil and graded smooth, reseeded, and mulched.

B. The Contractor shall also be responsible for repairs to all erosion of the seeded areas until new grass is firmly established and reaches a height of not less than 4 inches. All bare or poorly vegetated areas must be reseeded and mulched.

- END OF SECTION -

MATERIALS AND PERFORMANCE - SECTION 02234

GEOMEMBRANE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Under this section, the Contractor shall furnish and install textured high density polyethylene (HDPE) geomembrane material as shown on the Design Documents and as specified herein and/or directed.

2. The Contractor shall be responsible for all QA/QC specified herein and as indicated on the Design Drawings. All QA/QC testing, with the exception of non-destructive tests, shall be conducted by an independent laboratory at the Contractor's expense.

1.02 APPLICABLE CODES, STANDARDS, SPECIFICATIONS, AND PUBLICATIONS

A. American Society for Testing and Materials (ASTM)

1.	D413-88	Test Methods for Rubber Property -- Adhesion to Flexible Substrate
2.	D638-89	Test Method for Tensile Properties of Plastics
3.	D746-79	Test Method for Brittleness Temperature of Plastics and (Rev 1987) Elastometers by Impact
4.	D751-89	Method of Testing Coated Fabrics
5.	D792-86	Test Method for Specific Gravity and Density of Plastics by Displacement
6.	D882-90	Test Method for Tensile Properties of Thin Plastic Sheeting
7.	D1004-90	Test Method for Initial Tear Resistance of Plastic Film and Sheeting
8.	D1203-89	Test Methods for Volatile Loss from Plastics Using Activated Carbon Methods
9.	D1204-89	Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature
10.	D1238-90	Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer

MATERIALS AND PERFORMANCE - SECTION 02234

GEOMEMBRANE

11.	D1505-85	Test Method for Density of Plastics by the Density Gradient Technique
12.	D1603-76 (Rev. 1988)	Test Method for Carbon Black in Olefin Plastics
13.	D5397	Test Method for Environmental Stress-Cracking of Ethylene Plastics
14.	D1790-90	Test Method for Brittleness Temperature of Plastic Film by Impact
15.	D5996	Recommended Practice for Microscopical Examination of Pigment Dispersion in Plastic Compounds
16.	D4833	Puncture Resistance

B. Geosynthetic Research Institute (GRI)

GRI Test Method GM 13	Test Properties, Testing Frequencies and Recommended Warrant for High-Density Polyethylene (HDPE) Smooth and Textured Geomembranes

C. Where reference is made to one of the above codes, standards, specifications or publications the revisions in effect at the time of bid shall apply.

1.03 QUALIFICATIONS

A. Geomembrane Manufacturer

1. The Contractor shall submit to the Owner for approval the following information regarding the Geomembrane Manufacturer:

a. Corporate background and information.

b. Manufacturing capabilities including:

- Quality control procedures for manufacturing
- List of material properties including certified test results, to which geomembrane samples are attached.

c. A list of at least ten completed facilities, totaling a minimum of 10,000,000 ft^2, for which the Manufacturer has manufactured a geomembrane. For each facility, the following information shall be provided:

- Name and purpose of facility, its location and date of installation
- Name of Owner, Project Manager, Designer, Fabricator (if any), and Installer
- Thickness of geomembrane, surface area of geomembrane manufactured

d. Origin (resin supplier's name, resin production plan) and identification (brand name, number) of the resin.

B. Installer

1. The Installer must be trained and approved and/or licensed by the Geomembrane Manufacturer for the installation of geomembrane.

2. The Contractor shall submit to the Owner for approval the following written information, relative to the Installer.

a. Copy of Installer's letter of approval or license by the Manufacturer.

b. Resume of the "master seamer" to be assigned to this project, including dates and duration of employment.

3. All personnel performing seaming operations shall be qualified by experience or by successfully passing seaming tests. At least one seamer shall have experience seaming a minimum of 1,000,000 ft^2 of geomembrane of the type for this project, using the same type of seaming apparatus in use at the site.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Solmax Geosynthetics,
B. GSE Lining Technology, Inc., or
C. Approved equal.

2.02 MATERIALS

A. HDPE Lining Material Specifications

1. Textured HDPE geomembrane material shall meet the following minimum specification values listed below and as listed in GRI GM13.

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Property	Test Method	Specification Limit
		60 mil Textured
HDPE Geomembrane Resin		
Specific Gravity (min.)	ASTM D1505/D792	0.940 g/cc
Carbon Black Content	ASTM D1603	2.0-3.0 %
Carbon Black Dispersion	ASTM D5596	1, 2 or 3 category All 10 views
HDPE Geomembrane Rolls		
Mechanical		
Thickness (± 10%)	ASTM D5199	60 mil
Specific Gravity (min.)	ASTM D1505/D792	0.940 g/cc
Tensile Properties		
Tensile Strength at Break (min.)	ASTM D638 Type IV	90 ppi
Tensile Strength at Yield (min.)		126 ppi
Elongation at Break (min.)		100 %
Elongation at Yield (min.)		12%
Tear Resistance (min.)	ASTM D1004	42 lbs
Puncture Resistance (min.)	ASTM D4833	90 lbs
Stress Crack Resistance	ASTM D5397	200 Hour
Environmental Stress Cracking	ASTM D 1693	1500 Hour
HDPE Geomembrane Field and Factory Seams		
Oxidative Induction Time		
A. Standard OIT	D3895	100 min

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GEOMEMBRANE

Property	Test Method	Specification Limit
		60 mil Textured
B. High Pressure OIT	D5885	400 min
Oven Aging at 85°C	D5721	
A. Standard OIT - % Retained After 90 Days	D3895	55%
B. High Pressure OIT - % Retained After 90 Days	D5885	80%
UV Resistance	GM11	
A. Standard OIT	D3890	NR*
B. High Pressure OIT - % Retained After 1600 Hours	D5885	60%
Tensile Strength at Yield (min.)	ASTM D638 as modified by ANSI/NSF Standard 54	No failure of the seam and 90% of sheet value for adjacent material
Tensile Strength at Break (min.)	ASTM D638 as modified by ANSI/NSF Standard 54	No failure of the seam and 90% of sheet value for adjacent material
Peel Strength	ASTM D413 and D4437 as modified by ANSI/NSF Standard 54	No failures of the seam along original contact surface of liner panels

* NR = Not recommended

B. Welding Material

1. The resin used in the welding material must be identical to the liner material.

2. All welding materials shall be of a type recommended and supplied by the manufacturer and shall be delivered in the original sealed containers each with an indelible label bearing the brand name, manufacturer's mark number, and complete

directions as to proper storage.

C. Labeling Geomembrane Rolls

1. Labels on each roll or factory panel shall identify the following:

- The thickness of the material;
- The length and width of the roll or factory panel;
- The Manufacturer;
- Directions to unroll the material;
- Product identification;
- Lot number; and
- Roll or field panel number.

2.03 DELIVERY, HANDLING AND STORAGE

A. The Contractor shall be liable for all damages to the materials incurred prior to and during transportation to the site.

B. Handling, storage and care of the geosynthetic materials prior to and following installation at the site, is the responsibility of the Contractor. The Contractor shall be liable for all damages to the materials incurred prior to final acceptance of the lining system by the Owner.

C. The Contractor shall notify the Owner of the anticipated delivery time.

D. Rolls of material shall be stored on prepared surfaces (not pallets) and should not be stored more than two rolls high.

E. During shipment and storage, protect from ultraviolet light exposure, precipitation or other inundation, mud, dirt, dust, puncture, cutting, or other damaging or deleterious conditions. Ship and store in relatively opaque and water tight wrapping.

F. Geocomposites and geomembranes shall not be exposed to sunlight for more than 15 days unless otherwise specified or guaranteed by the manufacturer.

G. Deliver HDPE geomembrane material to site only after the approval of panel layout submittal.

H. Geocomposites and geomembrane damage will be documented. Repair damaged materials, if possible, or replace at no additional cost.

2.04 ADDITIONAL SUBMITTALS

A. The Contractor shall submit the following items for approval at least one week prior to

installation.

1. Shop drawings shall include:

   a. Layout plan;

   b. Quality control program manual covering all phases of manufacturing and installation; and

   c. Complete and detailed written instructions for the storage, handling, installation, seaming, inspection pass fail criteria for liner inspections, and QA/QC testing procedures of the liner in compliance with these specifications and the condition of his warranty.

PART 3 - EXECUTION

3.01 GEOMEMBRANE INSTALLATION

A. Related Earthwork

1. The Contractor shall insure that all related earthwork requirements under this section are complied with:

   a. The geomembrane installations shall be performed on a firm, smooth, soil surface free from stones or protruding objects.

   b. No geomembrane shall be placed onto an area which has become softened by precipitation or which has cracked due to desiccation. Appropriate methods of moisture control are the responsibility of the Contractor.

   c. No geomembrane shall be placed on frozen soil material. Such material shall be removed and replaced with new soil fill as specified in the MP Section entitled "Soil Fill."

   d. The Geomembrane Installer shall certify in writing that the final soil surface on which the membranes are to be installed are acceptable.

   e. All final soil surfaces on which the membranes are to be installed shall be acceptable to the Engineer prior to membrane installation.

   f. Free edges of geomembrane shall be secured in such a manner as to prevent uplift by wind or the intrusion of water under the liner. Edge protection shall include, sandbags, polyethylene sheeting or other methods as deemed necessary by the Contractor and approved by the Owner.

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GEOMEMBRANE

g. The geomembrane shall be anchored within an anchor trench constructed to the dimensions shown in the Design Drawings. Care shall be taken while backfilling the trenches to prevent damage to the geomembrane.

B. Geomembrane Deployment

1. Geomembrane shall be deployed according to the following procedures:

a. Placement of the geomembrane panels shall be according to the approved location and position plan provided by the Installer. Placement shall follow all instructions on the boxes or wrapping containing the geomembrane materials which describe the proper methods of unrolling panels.

b. The method of placement must ensure that:

- Deployed geomembrane must be visually inspected for uniformity, tears, punctures, blisters or other damage or imperfections. Any such imperfections shall be immediately repaired and reinspected.
- No equipment used shall damage the geomembrane by handling, trafficking, leakage of hydrocarbons, or other means.
- No personnel working on the geomembrane shall smoke, wear damaging shoes, or engage in other activities which could damage the geomembrane.
- The prepared surface underlying the geomembrane must not be allowed to deteriorate after acceptance and must remain acceptable up to the time of geomembrane placement and until completion of the project.
- Adequate temporary loading and/or anchoring (e.g., sand bags), not likely to damage the geomembrane, shall be placed to prevent uplift by wind (in case of high winds, continuous loading is recommended along edges of panels to minimize risk of wind flow under the panels).
- Direct contact with the geomembrane shall be minimized; i.e., the geomembrane in excessively high traffic areas shall be protected by geotextiles, extra geomembrane, or other suitable materials.

c. Any damage to the geomembrane panels or portions of the panels as a result of placement must be replaced or repaired at no cost to the Owner. The decision to replace or repair any panel or portions of panels shall be made by the Owner.

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d. The Installer shall assign an "identification number" to each geomembrane panel placed. The number system used shall be simple, logical and identify the relative location in the field.

C. Seaming

1. The seaming procedures below shall be implemented, where applicable, during installation of the geomembrane. The seaming procedures are as follows:

a. Generally, all seams whether field or factory, shall be orientated parallel to the line of slope, not across slope. This specification applies to all slopes in excess of 10 percent grade. At liner penetrations and corners, the number of seams shall be minimized.

b. The area of the geomembrane to be seamed shall be cleaned and prepared according to the procedures specified by the material manufacturer. Any abrading of the geomembrane shall not extend more than one-half inch on either side of the weld. Care shall be taken to eliminate or minimize the number of wrinkles and "fishmouths" resulting from seam orientation.

c. Field seaming is prohibited when either the air or sheet temperature is below 32°F or when the sheet temperature exceeds 158°F or when the air temperature is above 120°F. At air or sheet temperatures between 32°F and 40°F, seaming shall be conducted directly behind a preheating device. In addition, seaming shall not be conducted when geomembrane material is wet from precipitation, dew, fog, etc., or when winds are in excess of 20 miles per hour.

d. Seaming shall not be performed on frozen or excessively wet underlying soil surfaces.

e. Seams shall have an overlap beyond the weld large enough to perform destructive peel tests, but not exceed 5 inches.

f. The Contractor shall perform trial seams on excess geomembrane material. A 1 foot by 3 foot seamed liner sample shall be fabricated with the seam running down the 3 foot length in the center of the sample. Such trial seaming shall be conducted prior to the start of each seaming succession for each seaming crew, change in machine or every 4 hours, after any significant change in weather conditions or geomembrane temperature, or after any change in seaming equipment. From each trial seam, two field test specimens shall be taken. The test specimens shall be 1 inch by 12 inch strips cut perpendicular to the trial seam. These specimens shall be peel tested using a field tensiometer, and recorded as pass (failure of liner material) or fail (failure of seam). Upon initial failure, a second trial seam

shall be made; if both test specimens do not pass, then the seaming device and its operator shall not perform any seaming operations until the deficiencies are corrected and two successive passing trial seam test specimens are produced. Completed trial seam samples cannot be used as portions of a second sample and must be discarded.

g. Where fishmouths occur, the material shall be cut, overlapped and an overlap weld shall be applied. Where necessary, patching using the same liner material shall be welded to the geomembrane sheet.

h. Acceptable seaming methods for geomembrane are:

- extrusion welding using extrudate with identical physical, chemical, and environmental properties; and
- hot wedge welding using a proven fusion welder and master seamer.

i. Seaming device shall not have any sharp edges which might damage the geomembrane liner. Where self-propelled seaming devices are used, it shall be necessary to prevent "bulldozing" of the device into the underlying soil.

D. Seam Testing

1. The Contractor shall perform nondestructive seam testing on 100 percent of field seams. The following test method and procedures may be used:

a. Air pressure testing may be used if double track hot wedge welding has been utilized to seam the HDPE geomembrane. Using approved pressure testing equipment, the following procedures will be followed:

- seal both ends of the air channel separating the double hot wedge welds;
- insert pressure needle into air channel and pressurize the air channel to 25 psi; and
- monitor pressure gauge for 3 minutes and determine whether pressure is maintained without a loss of more than 2 psi;
- if the pressure test fails, then localize the leak and mark the area for repair.

Air pressure testing will be conducted under the direct observation of the Engineer.

b. Vacuum testing will be used on all seams not tested using air pressure

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testing. Using an approved vacuum box, the following procedures will be followed:

- apply a soapy water mixture over the seam;
- place vacuum box over soapy seam and form a tight seal;
- create a vacuum by reducing the vacuum box pressure to 5 psi (35 KPa) for 30 seconds;
- observe through the vacuum box window any bubbles;
- where bubbles are observed, mark seam for repair;
- move vacuum box further down seam overlapping tested seam by 3 inches; and
- where hot wedge seaming has been performed, the overlap must be cut back to the weld.

All vacuum testing will be conducted under the direct observation of the Engineer.

2. In addition to nondestructive seam testing, the Contractor will perform destructive testing. The destructive testing procedures are as follows:

a. Test samples will be prepared by the Installer every 500 feet of seam length, a minimum of one test for each seaming machine per day, or more frequently at the discretion of the Engineer. Sample location and size will be selected by the Engineer. The sample size (12 x 56 inches) will be large enough to produce three sets of test specimens for the following tests:

- Seam Shear Strength, ASTM D816 as modified in ANSI/NSF Std. 54
- Peel Adhesion, ASTM D413 and D4437 as modified in ANSI/NSF Std. 54
- Adjacent Geomembrane Elongation, ASTM D4437

b. Ten specimens will compose a set. Five of these will be tested for peel and the other five for shear strength. Each specimen will be 1 inch wide and 12 inches long with the field seam at the center of the specimen. The 56 inch sample length will first be cut at the ends to produce two field peel test specimens. The remaining 54 inches will be divided up into thirds and one-third submitted to the Contractor, one-third to the independent testing laboratory, and one-third to the Engineer for storage and future reference.

c. Test specimens will be considered passing if the minimum values below are met or exceeded for four of the five test specimens tested by the independent laboratory. All acceptable seams will lie between two locations where samples have passed.

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d. The cost of destructive testing will be borne by the Contractor.

Field Seam Properties	Specification Limit	Test Method
Shear Strength at Yield (lb/in width)	90% of specification limit of sheet value for adjacent material	ASTM D816 as modified in ANSI/NSF Standard 54
Peel Adhesion	Film tear bond	ASTM D413 as modified in ANSI/NSF Standard 54
Adjacent Geomembrane Elongation	100%	ASTM D4437

3. If a sample fails destructive testing, the Contractor shall ensure that: the seam is reconstructed in each direction between the location of the sample which failed and the location of the next acceptable sample; or the welding path is retraced to an intermediate location at least ten feet in each direction from the location of the sample which failed the test, and a second sample is taken for an additional field test. If this second test sample passes, the seam must be then reconstructed between the location of the second test and the original sampled location. If the second sample fails, the process must be repeated.

   All costs for work performed to achieve passing tests along with costs for retesting will be borne by the Contractor.

4. If double track hot-wedge welding is used, the Engineer and the Installer must agree on the track weld that will be used in the destructive testing. The weld chosen inside or outside must be consistently tested and pass according to the criteria above.

5. All holes created by cutting out destructive samples will be patched by the Contractor immediately with an oval patch of the same material welded to the membrane using extrusion welding. The patch seams will be tested using a vacuum box and using the procedures described above. Work will not proceed with materials covering the geomembrane until passing results of destructive testing have been achieved.

6. At the ends of each field seam, two field test specimens will be taken and field tested with a field tensiometer. Both specimens must pass prior to placing the membrane in the anchor trench or continuing with additional seams. Failure of these specimens will require correcting the seaming device and repair of the preceding seam according to the failure testing and procedures described above.

E. Liner Repair

MATERIALS AND PERFORMANCE - SECTION 02234

GEOMEMBRANE

1. All imperfections, flaws, construction damage, destructive and nondestructive seam failures shall be repaired by the Installer of the geomembrane materials. The appropriate methods of repair are listed below:

- Patching, used to repair holes, tears, undispersed raw materials and contamination by foreign matter;
- Grinding and rewelding, used to repair small sections of extruded seams;
- Spot welding or seaming, used to repair pinholes or other minor, localized flaws;
- Capping, used to repair large lengths of failed seams;
- Topping, used to repair areas of inadequate seams, which have an exposed edge; and

- Removing bad seam and replacing with a strip of new material welded into placed, used with large lengths of fusion seams.

F. Construction Material Placement and Penetrations

1. Wrinkles that develop from normal placement procedures must be controlled such that the underlying geomembrane does not fold over. Small wrinkles, defined as having their height less than or equal to one-half their base width, may be trapped and pushed down by the overlying soil. Any wrinkle which becomes too large and uncontrollable or which folds the geomembrane over must be brought to the attention of the Owner and Engineer. If necessary, the geomembrane shall be uncovered, cut, laid flat, seamed by extrusion welding and non-destructively tested. Any wrinkle repairs within 10 feet of the cell valley shall be uncovered, cut, laid flat, seamed by extrusion weld, non-destructively tested and covered with a cap strip which is extrusion-welded and non-destructively tested.

3.02 POST-CONSTRUCTION

A. The Installer of the geomembrane materials shall prepare and the Contractor shall submit, to the Owner, record drawings illustrating the following information:

- dimensions of all geomembrane field panels
- panel locations referenced to the Design Drawing plans
- identify all field seams and panels with the appropriate number or code
- location of all patches, repairs and destructive testing samples

B. Record Drawing(s) shall be submitted for each geomembrane layer constructed.

3.03 WARRANTY

A. The Contractor shall obtain and submit to the Owner from the Manufacturer a standard warranty provided for the geomembrane. The Engineer shall review the warranty for

MATERIALS AND PERFORMANCE - SECTION 02234

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completeness prior to the Owner accepting its provisions.

- END OF SECTION -

MATERIALS AND PERFORMANCE - SECTION 02201

EARTHWORK

1.01 DESCRIPTION

A. Work Specified

1. Under this section, the Contractor shall furnish all labor, materials and equipment for the excavation and backfilling, involving the loosening, removing, transporting, storing, and disposing of all materials necessary to be removed for the construction and completion of all work under the Contract.

2. Excavations shall be made in the areas and to the depths shown on the Design Drawings, as specified herein, and/or as directed.

B. Related Work Specified Elsewhere

1. Section MP-02221 - Soil Fill

C. Definitions

1. Excavation (or Trenching)

a. Grubbing, stripping, removing, storing and rehandling of all materials of every name and nature necessary to be removed for all purposes incidental to the construction and completion of all the work under construction.

b. All sheeting, sheetpiling, bracing and shoring, and the placing, driving, cutting off and removing of the same.

c. All diking, ditching, fluming, cofferdamming, pumping, bailing, draining, well pointing or otherwise disposing of water.

d. The removing and disposing of all surplus materials from the excavations in the manner specified.

e. The maintenance, accommodation and protection of travel and the temporary paving of highways, roads and driveways.

f. The supporting and protecting of all tracks, rails, buildings, curbs, fences, sidewalks, pavements, overhead wires, poles, trees, vines, shrubbery, pipes, sewers, conduits or other structures or property in the vicinity of the work, whether over or underground or which appear within or adjacent to the excavations, and the restoration of the same in case of settlement or other injury.

g. All temporary bridging and fencing and the removing of same.

MATERIALS AND PERFORMANCE - SECTION 02201

EARTHWORK

2. Earth

   a. All materials such as sand, gravel, clay, loam, ashes, cinders, pavements, muck, roots or pieces of timber, soft or disintegrated rock, not requiring blasting, barring, or wedging from their original beds, and specifically excluding all ledge or bedrock and individual boulders or masonry larger than ½-cubic yard in volume.

3. Backfill

   a. The refilling of excavation and trenches to the line of filling indicated on the Design Drawings or as directed using materials suitable for refilling of excavations and trenches; and the compacting of all materials used in filling or refilling by rolling, tamping, or as may be required and approved by the Owner.

4. Spoil

   a. Surplus excavated materials not required or not suitable for backfills or embankments.

5. Embankments

   a. Fills constructed above the original surface of the ground or such other elevation as specified or directed.

6. Limiting Subgrade

   a. The underside of the pipe barrel for pipelines.

   b. The underside of footing lines for structures.

   c. All elevations noted as subgrade or top of subgrade.

7. Excavation Below Subgrade

   a. Excavation below the limiting subgrades of structures or pipelines.

   b. Where materials encountered at the limiting subgrades are not suitable for proper support of subsequent soil layers, pipelines, structures, or geosynthetics, the Contractor shall excavate to such new lines and grades as required.

D. Applicable Codes, Standards and Specifications

1. American Society for Testing and Materials (ASTM)

MATERIALS AND PERFORMANCE - SECTION 02201

EARTHWORK

a. ASTM A328M-90 Specification for Steel Sheet Piling

b. ASTM D1557-91 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort

c. ASTM D1556-90 Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

d. ASTM D2922-91 Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods

PART 2 - PRODUCTS

2.01 DESCRIPTION

A. Steel Sheeting and Bracing

1. Shall be sound.

2. Shall conform to ASTM A328M-90 with a minimum thickness of 3/8 inch.

PART 3 - EXECUTION

3.01 UNAUTHORIZED EXCAVATION

A. Description

1. Whenever excavations are carried beyond or below the lines and grades shown on the Design Drawings, or as given or directed by the Engineer, all such excavated space shall be refilled with special granular materials, concrete, or other materials as the Engineer may direct. All refilling of unauthorized excavations shall be at the Contractor's expense.

2. All material which slides, falls or caves into the established limits of excavations due to any cause whatsoever, shall be removed and disposed of at the Contractor's expense and no extra compensation will be paid to the Contractor for any materials ordered for refilling the void areas left by the slide, fall or cave-in.

3.02 REMOVAL OF WATER

A. General

1. The Contractor shall, at all times, provide and maintain proper and satisfactory means and devices for the removal of all water entering the excavations, and shall remove all such water as fast as it may collect, in such manner as shall not interfere with the execution of the work or the proper placing of pipes, structures, or other work. Removal of water which enters excavations shall be coordinated with the

Owner. Water removed from excavations located outside the limits of the membrane may be discharged to the surface at the direction of the Engineer. The disposal of all water shall be performed by the Contractor at no additional cost to the Owner.

2. Unless otherwise specified, all excavations which extend down to or below the static ground-water elevations shall be dewatered. The ground water shall be maintained beneath such excavations at all times when work thereon is in progress, during subgrade preparation and the placing of the structure or pipe thereon.

3. Water shall not be allowed to rise over or come in contact with any masonry, concrete or mortar, until at least 24 hours after placement, and no stream of water shall be allowed to flow over such work until such time as the Engineer may permit.

4. Where the presence of fine-graded subsurface materials and a high ground-water table may cause the upwind flow of water into the excavation with a resulting quick or unstable conditions, the Contractor shall install and operate an approved well point system designed by a registered professional engineer to prevent the upward flow of water during construction.

5. Water pumped or drained from excavations, or any sewers, drains or water courses encountered in the work, shall be disposed of in a suitable manner without injury to adjacent property, the work under construction, or to pavement, roads, drives and water courses. No water shall be discharged to sanitary sewers.

6. Any damage caused by or resulting from dewatering operations shall be the sole responsibility of the Contractor.

B. Work Included

1. The construction and removal of cofferdams, sheeting and bracing, and the furnishing of materials and labor necessary therefore.

2. The excavation and maintenance of ditches and sluiceways.

3. The furnishing and operation of pumps, well points and appliances needed to maintain thorough drainage of the work in a satisfactory manner.

3.03 STORAGE OF MATERIALS

A. Sod

1. Any clean sod cut during excavation shall be removed and stored during construction so as to preserve the grass growth. Sod damaged while in storage shall be replaced in like kind at the sole expense of the Contractor.

MATERIALS AND PERFORMANCE - SECTION 02201

EARTHWORK

B. Topsoil

1. Topsoil suitable for final grading shall be removed and stored separately from other excavated material.

C. Excavated Materials

1. All excavated materials shall be stored in locations approved by the Owner so as not to endanger the work, and so that easy access may be had at all times to all parts of the excavation. Stored materials shall be kept neatly piled and trimmed, so as to cause as little inconvenience as possible to the public traveler or adjoining property holders.

2. Special precautions must be taken to permit access at all times to fire hydrants, fire alarm boxes, police and fire department driveways, and other points where access may involve the safety and welfare of the general public.

3.04 DISPOSAL OF MATERIALS

A. Spoil Material

1. Spoil material shall be disposed of on-site at a location approved by the Owner. Locating, maintaining, and transporting to such locations shall be the responsibility of the Contractor and no separate payment will be made for such work.

3.05 SHEETING AND BRACING

A. Installation

1. The Contractor shall furnish, place and maintain such sheeting, bracing and shoring as may be required to support the sides and ends of excavations in such manner as to prevent any movement which could, in any way, injure the pipe, structures, or other work; diminish the width necessary for construction; otherwise damage or delay the work of the Contract; endanger existing structures, pipes or pavements; or cause the excavation limits to exceed the right-of-way limits.

2. In no case will bracing be permitted against pipes or structures in trenches or other excavations.

3. Sheeting shall be driven as the excavation progresses and in such manner as to maintain pressure against the original ground at all times. The sheeting shall be driven vertically with the edges tight together, and all bracing shall be of such design and strength as to maintain the sheeting in its proper position.

4. The Contractor shall be solely responsible for the adequacy of all sheeting and bracing.

MATERIALS AND PERFORMANCE - SECTION 02201

EARTHWORK

B. Removal

1. In general, all sheeting and bracing, whether of steel, wood or other material, used to support the sides of trenches or other open excavations, shall be withdrawn as the trenches or other open excavations are being refilled. That portion of the sheeting extending below the top of a pipe or structural foundation shall not be withdrawn, unless otherwise directed, before more than 6 inches of earth is placed above the top of the pipe or structural foundation and before any bracing is removed. The voids left by the sheeting shall be carefully refilled with selected material and rammed tight with tools especially adapted for the purposes or otherwise as may be approved.

2. The Contractor shall not remove sheeting and bracing until the work has attained the necessary strength to permit placing of backfill.

3. No sheeting or bracing shall be left in-place following completion of the work.

3.06 BACKFILLING

A. General

1. All excavations shall be backfilled to the original surface of the ground or to such other grades as may be shown, specified or directed.

2. Backfilling shall be done with suitable soil fill materials which can be satisfactorily compacted during refilling of the excavation. In the event the soil fill materials are not suitable as determined by the Engineer new soil fill material shall be obtained by the Contractor for backfilling.

3. Any settlement occurring in the backfilled excavations shall be refilled and compacted.

B. Unsuitable Materials

1. Stones, pieces of rock, foundry materials, and/or pieces of pavement greater than one cubic foot in volume or greater than 1½ feet in any single dimension shall not be used in any portion of the backfill.

2. All stones, pieces of rock, pavement, or other material shall be distributed through the backfill and alternated with earth backfill in such a manner that all interstices between them shall be filled with earth.

3. Frozen earth shall not be used for backfilling.

C. Compaction and Density Control

1. The compaction shall be as specified for the type of earthwork, i.e., structural,

trenching or embankment.

a. The compaction specified shall be 90% of maximum dry density.

b. The compaction equipment shall be suitable for the material encountered.

2. Where required, to assure adequate compaction, in-place density tests shall be made by an approved testing laboratory.

a. The moisture-density relationship of the backfill material shall be determined by ASTM D1557.

1. Compaction curves for the full range of materials used shall be developed.

b. In-place density shall be determined by the methods of ASTM D1556 or ASTM D2922 and shall be expressed as a percentage of maximum dry density.

c. In-place density testing shall be conducted at a rate of one test per lift placed.

3. Where required, to obtain the optimum moisture content, the Contractor shall add, at his expense, sufficient water during compaction to assure the specified maximum density of the backfill. If, due to rain or other causes, the material exceeds the optimum moisture content, it shall be allowed to dry, assisted if necessary, before resuming compaction or filling efforts.

4. The Contractor shall be responsible for all damage or injury done to pipes, structures, property or persons due to improper placing or compacting of backfill.

3.07 OTHER REQUIREMENTS

A. Drainage

1. All materials deposited in roadway ditches or other water courses shall be removed immediately after backfilling is completed and the section, grades and contours of such ditches or water courses restored to their original condition, in order that surface drainage will be obstructed no longer than necessary.

B. Unfinished Work

1. When, for any reason, the work is to be left unfinished, all trenches and excavations shall be filled and all roadways, sidewalks and watercourses left unobstructed with their surfaces in a safe and satisfactory condition. The surface of all roadways and sidewalks shall have a temporary pavement.

MATERIALS AND PERFORMANCE - SECTION 02201

EARTHWORK

C. Hauling Material on Streets

1. When it is necessary to haul material over the streets or pavement, the Contractor shall provide suitably tight vehicles so as to prevent deposits on the street or pavements. In all cases, where any materials are dropped from the vehicles, the Contractor shall clean up the same as often as required to keep the crosswalks, streets, and pavements clean and free from dirt, mud, stone and other hauled material.

D. Dust Control

1. It shall be the sole responsibility of the Contractor to control the dust created by any and all of his operations to such a degree that it will not endanger the safety and welfare of the general public.

E. Test Pits

1. For the purpose of obtaining detailed locations of underground obstruction, the Contractor shall make excavations in advance of the work. The Contractor shall consider such work as incidental to the work involved, and no separate payment will be made for such work.

- END OF SECTION -

MATERIALS AND PERFORMANCE - SECTION 02221

SOIL FILL

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Work under this section shall include, but not necessarily be limited to, supplying, excavating, transporting, dumping, spreading, and compacting soil fill material in the locations and to the depth shown on the Design Drawings or as directed. Soil fill material will be used in the construction of roads, subgrade, structural backfill, and the cover system protection soil layer.

B. Soil fill shall consist of material excavated from approved off-site sources. The contractor shall identify the source(s) for fill materials to the NYSDEC at least two weeks prior to beginning any backfilling activities. The contractor will coordinate for the collection of a representative composite sample from each source area for laboratory analysis, as specified in Section 2.4.6. The analytical results will then be submitted to the NYSDEC for approval of the fill materials. In addition, appropriate methods (e.g., screening) shall be employed, as required, by the Contractor to ensure all soil fill material meets the particle size requirements.

1.02 RELATED WORK

A. MP-Section 02201 Earthwork

1.03 REFERENCES

A. American Society for Testing Materials (ASTM).

1.04 SUBMITTALS

A. The Contractor shall submit sieve analyses and compaction tests to the Engineer for review prior to usage of soil fill materials on the site. The Contractor must also submit documentation as to the source of the soil fill, the source property owner, and any test results requested by the Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Soil fill material shall be free from excessive moisture, frost, stumps, trees, roots, sod, muck, marl, vegetation matter, or other unsuitable materials. Soil fill material shall have an organic content of less than 0.5 percent as determined using a loss on ignition test and shall not contain detectable levels of target compound list organic chemical contaminants. Soil fill material shall be certified clean by the materials supplier.

B. Acceptable soil fill material for use as structural backfill and for subgrades shall be suitable

MATERIALS AND PERFORMANCE - SECTION 02221

SOIL FILL

for compaction in layers not exceeding twelve (12) inches in compacted thickness and shall remain stable when wet. Soil fill shall have a maximum particle size of 6 inches. Acceptable soil fill material below or otherwise within 1 foot of a culvert, buried pipe or geosynthetic material within the cover system shall have a maximum particle size of 1 inches.

PART 3 - EXECUTION

3.01 PLACEMENT

A. The entire surface to be covered with soil fill material shall be stripped of all grass, vegetation, topsoil, rubbish, or other unsuitable materials before backfilling.

B. In general, soil fill material shall be placed and compacted in horizontal layers not exceeding twelve (12) inches in compacted thickness and stones shall not exceed six (6) inches in greatest dimension and shall be well distributed throughout the mass. Subgrade for soil fill material shall be approved by the Engineer. Soil fill material shall not be placed on ground which will not support the weight of construction equipment.

C. Each layer of soil fill material shall be thoroughly tamped or rolled to the required degree of compaction by sheepsfoot, mechanical tampers, or vibrators. Successive layers shall not be placed until the layer under construction has been thoroughly compacted.

D. Trucks or other heavy equipment shall not be operated over pipelines until a minimum of twenty-four (24) inches of backfill above the crown of the trenched pipe has been placed and properly compacted by tampers or other approved method.

E. Where required, the Contractor shall, at his own expense, moisture condition the fill to meet the compaction requirements of the specification. If, due to rain or other causes, the material is too wet for satisfactory compaction, it shall be allowed to dry or be removed as required, before compaction.

3.02 FIELD TESTING AND QUALITY CONTROL

A. Soil fill material shall be compacted to a minimum dry density of 90 percent of the maximum dry weight density in pounds per cubic foot as determined by the Modified Proctor Compaction Test, ASTM D-1557 unless otherwise noted on the Design Drawings. Soil fill used in the protection soil layer shall be compacted with two passes of suitable compation equipment. Density testing is not required for the soil fill component of the protection soil layer. Compaction tests shall be performed by the Owner.

B. Compaction curves shall be developed for use in the construction of roads, subgrades, and structural backfill. The development of the curves from the Modified Proctor Compaction Test shall be done by an approved testing laboratory at the Owner's expense with the Contractor supplying equipment and personnel as required to assist in the taking of samples.

C. Soil fill material shall be constructed to such heights as to make allowance for construction settlement. Any settlements which occur before final acceptance of the Contract shall be corrected to make the backfill confirm with the established lines and grades.

- END OF SECTION -

MATERIALS AND PERFORMANCE - SECTION 01050
SURVEYING

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. Under this section, the Contractor shall furnish all labor, materials, and equipment to perform all work necessary to complete surveying activities during excavation, consolidation, and cap construction. The work shall be done in accordance with these specifications and in conformity with the lines and grades shown on the Plans or established by the Engineer.

2. Surveys shall be performed by persons practiced in land survey techniques and under the direction of a Professional Land Surveyor licensed in the State of New York.

1.02 RELATED WORK

1. Section MP- 02201 - Earthwork
2. Section MP- 02221 - Soil Fill

1.03 REFERENCES

1. NYSDOT Standard Specifications - Construction and Materials (Latest Edition)

1.04 SUBMITTALS

A. The submittals described below are minimum requirements for surveying. Additional surveys needed to document quantities for payment will also be performed as directed by the ENGINEER.

B. DRAWINGS

1. Initial topographic map

- Prior to site disturbance, provide topographic map of project site which refers to the Bern property, limits of excavation in the adjacent properties (Conrail South, Universal Metals, Laub, and the Conrail Right-of-Way), the Clinton/Bender properties, other areas where site activities will be conducted, on-site structures, and utilities.

2. Intermediate submittals

MATERIALS AND PERFORMANCE - SECTION 01050
SURVEYING

- Upon completion of excavation within an area, the CONTRACTOR shall provide an intermediate drawing depicting final excavation depths and limits.

3. As-built topographic maps

- Provide as-built topographic maps upon completion of the following activities:

  - All excavation activities, depicting final excavation limits. The final excavation limits shall be depicted by indicating the depth and area of excavation in each area.

  - Subgrade construction, prior to final cap placement over the Bern property, including restored excavation areas.

  - Final cap placement.

C. INTERMEDIATE EXCAVATION LIMITS

1) Prior to placing backfill material in any excavation, the CONTRACTOR shall provide the excavation limits to the ENGINEER for review. Backfill shall not be placed in the excavation without prior approval from the ENGINEER.

D. RECORDS

1) AutoCad Version 12 compatible electronic files of all surveys. Provide data on 3.5-inch diskettes.

2) Field Data. Original final survey book (hard bound) upon completion of each phase of survey work. Include all field notes, notations, and descriptions used and compiled during the field survey. Photocopies or carbon copies are not acceptable.

3) Coordinate List. Final coordinate list of all survey points with specific coordinates and elevations.

4) Volume Quantity Calculations. All calculations required to support requests for payments and verifications of volumes and areas involved.

MATERIALS AND PERFORMANCE - SECTION 01050
SURVEYING

PART 2 - PRODUCTS

2.01 DESCRIPTION

A. Permanent Site Control Monument

1. Provide in accordance with NYSDOT Specification, Section 626.

PART 3 - EXECUTION

3.01 General Requirements

A. Personnel

1. All work in this section shall be performed by persons practiced in land survey techniques and under the direction of a Professional Land Surveyor licensed in the State of New York.

B. Horizontal and Vertical Control

1. Horizontal and vertical control points shall be referenced to the permanent site control monuments to an accuracy of one part in ten thousand. Provide control points at each location of work using closed traverse and leveling and fill limits to document the areas remediated.

C. Excavation Limits

1. The limits of soil to be excavated will be located and staked. The CONTRACTOR will be responsible for placing and maintaining survey control stakes in excavation and fill areas for the duration of construction. The stakes will note the depth of cut or fill required at various areas for the duration of construction.

2. A survey shall be performed of each excavation area following completion of excavation within each area to document actual excavation volumes.

C. As-built Topographic Maps

1. Reproducible base map at a scale of 1 inch = 50 feet with 1-foot elevation contours upon which the CONTRACTOR shall plot the required survey information for each required submittal.

MATERIALS AND PERFORMANCE - SECTION 01050
SURVEYING

2. Mapping shall conform to the National Map Accuracy Specifications and shall bear the seal of a licensed land surveyor registered in New York. Map shall contain a title block with the name and address of the CONTRACTOR and the seal and signature of the registered surveyor. As-built drawings shall include labeled contour lines, property line locations, horizontal grid systems, cross-sections and details modified to show "as-built" conditions, details and cross-sections not on original drawings, and any field changes of elevations, dimensions, and details.

3. Indicate locations of physical features including residential areas and other areas which were used for site activities including: utilities, roadways, culverts, manholes, utility poles, fences, gates, drainage ditches, monitoring wells, piezometers and bench marks.

4. Indicate on a separate drawing: excavation limits and verification sampling points, if applicable.

C. Coordinate List

1. Compute the coordinates of each surveyed point on the New York State Plane Coordinate System using the 1983 North American Datum. The elevations shall be on the National Geodetic Vertical Datum.

D. Site Control

1. Provide one permanent site control monument with elevations referenced to a National Geodetic Vertical Datum (NGVD) benchmark and coordinates referenced to the New York State Plane (NAD 83) Datum. The monument locations and elevations shall meet the Federal Geodetic Control Committee Standard for second order (horizontal and vertical). Final locations will be reviewed by the ENGINEER for acceptability.

E. Survey Notes

1. Record all field work in a clear, legible, and complete manner. The Field Notes shall contain a complete description of the nature and location of the new and existing points. The record shall also include a sketch of the point locations, and the monument witness points.

- END OF SECTION -

MATERIALS AND PERFORMANCE - SECTION 02935
OFF-SITE TRANSPORTATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. This section includes procedures to transport all items specified for off-site disposal.

1.02 RELATED WORK

Section 02940, Off-Site Disposal

1.03 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

CODE OF FEDERAL REGULATIONS (CFR)

40 CFR 263 Standards Applicable to Transporters of Hazardous Wastes

49 CFR 172 Education, Hazardous material transportation, Hazardous waste, Labeling, Markings, Packaging and containers, Reporting and recordkeeping requirements

CODES, RULES, AND REGULATIONS OF THE STATE OF NEW YORK (NYCRR)

6 NYCRR Part 364 Waste Transportation Permits

6 NYCRR Part 372 Hazardous Waste Manifest System and Related Standards for Generators, Transporters, and Facilities

1.04 PERMITS AND REGULATIONS

Comply with all municipal, county, state, and federal regulations regarding transportation of hazardous and nonhazardous materials. These include:

A. Trucks used for transportation of material for disposal off site shall be permitted pursuant to 6 NYCRR Part 364;

B. Vehicle operator possession of a commercial driver's license with hazardous

materials endorsement (if applicable);

C. Registration of vehicle as a hazardous waste carrier (if applicable);

D. Utilization of shipping papers or hazardous waste manifest (40 CFR 263 and 6 NYCRR Part 372);

E. Proper marking and placarding of vehicles in accordance with 49 CFR 172;

F. Placement of emergency response procedures and emergency telephone numbers in vehicle, and operator familiarity with emergency response procedures (see Section 01450, "Minimum Requirements for Health and Safety"); and

G. Compliance with load, height, and weight regulations.

1.05 SUBMITTALS

A. Prior to sending any loads of soil onto public roadways or private right-of-ways, the CONTRACTOR must notify the ENGINEER of the intended transporter(s), transportation routes to be utilized for off-site transport of wastes.

B. This submittal shall be included in the overall Site, Management, and Operations Plan (SMOP) to be prepared by the CONTRACTOR and submitted to the DEPARTMENT.

PART 2 - PRODUCTS

2.01 DESCRIPTION

A. Equipment supplied shall be in good repair and good working condition. Equipment and machinery delivered to the site, including haul trucks, that have visible oil or hydraulic fluid leaks will not be allowed on site until satisfactorily repaired. Cleanup any oil or hydraulic fluid spills.

B. Trucks used for transportation of hazardous materials for off site disposal shall be water tight and permitted pursuant to 6 NYCRR Part 364.

PART 3 - EXECUTION

3.01 VEHICLE LOADING AND DECONTAMINATION

A. The CONTRACTOR shall provide all equipment, personnel, and facilities necessary to load waste materials in accordance with the regulatory requirements

listed herein, and in accordance with the regulations of those states through which the CONTRACTOR plans to transport materials.

B. Vehicle operators shall be trained in conformance with federal and state regulations for waste haulers (hazardous, special, and nonhazardous).

3.02 MANIFESTING

A. Provide all transporter-required information for completion of manifest forms.

B. Comply with 6 NYCRR Part 372 in completion and submittal of the Hazardous Waste Manifests. The Hazardous Waste Manifests for the transportation and disposal of waste removed from the site shall include all information in accordance with 49 CFR 172.101.

C. The ENGINEER will prepare and sign the special waste or hazardous waste manifest as an agent for the OWNER, which is the generator.

D. Place on the manifest all information and data required by the waste transporter. Provide the ENGINEER with three fully executed copies of each shipment manifested.

E. See Section 02940, "Off-site Disposal" for reporting procedures upon permanent disposal of the waste.

3.03 TRANSPORTATION

A. The CONTRACTOR shall be responsible for any and all actions to remediate spills in transit.

B. Prior to shipment of hazardous wastes off the project area, the CONTRACTOR shall confirm by written communication from the designated transporter(s) that they are authorized to deliver the manifested waste to the designated TSDF or SWMF.

C. Decontamination of the trucks shall **not** be performed by the Contractor prior to leaving the site because the excavated soils shall be "clean loaded" into the trucks as specified in the Remedial Design Report. Do not allow soil to be tracked off site at any time during the project. Visible soil tracks on streets will not be allowed. Take sufficient precautions to prevent loose soils from adhering to tire treads, wheel wells, and undercarriages of vehicles leaving the site. Remove visible soil tracks from streets caused by vehicles entering and leaving the site.

MATERIALS AND PERFORMANCE - SECTION 02935
OFF-SITE TRANSPORTATION

D. Excavated materials containing free liquids shall be loaded into trucks with water-tight structure or the materials shall pass the Paint Filter Test according the SW-846, Method 9095 prior to loading.

- END OF SECTION -

MATERIALS AND PERFORMANCE - SECTION 02940
OFF-SITE DISPOSAL

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Specified

1. This section includes procedures for off-site disposal of wastes.

1.02 RELATED WORK

Section 02935, Off-Site Transportation

1.03 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

CODE OF FEDERAL REGULATIONS (CFR)

40 CFR 262 Standards Applicable to Generators of Hazardous Wastes

CODES, RULES, AND REGULATIONS OF THE STATE OF NEW YORK

6 NYCRR Part 372	Hazardous Waste Manifest System and Related Standards for Generators, Transporters, and Facilities
6 NYCRR Part 373-1	Hazardous Waste Treatment, Storage and Disposal Facility Permitting Requirements

PART 2 - PRODUCTS

2.01 DESCRIPTION

A. Not used.

PART 3 - EXECUTION

3.01 GENERAL DISPOSAL REQUIREMENTS

A. The contractor must notify the ENGINEER of the disposal facilities to be used for treatment/disposal of wastes to be sent off-site at least two weeks prior to

shipping wastes to these facilities. The disposal facilities designated by the CONTRACTOR must be approved by the ENGINEER prior to shipment of wastes to the facilities.

B. Prior to shipment of hazardous wastes off the site, the CONTRACTOR shall confirm by written communication from the designated TSDF that it is authorized, has the capacity, and will provide or assure that the ultimate disposal method is followed for the particular hazardous waste on the manifest.

3.02 RCRA WASTES

A. The facility must have a RCRA permit or RCRA Interim Status for RCRA wastes.

B. The facility must not have any significant RCRA violations or other environmental conditions that could affect its satisfactory operation.

(1) Significant violations include Class 1 RCRA violations as defined in EPA's RCRA Enforcement Response Policy dated December 1984, including but not limited to groundwater, closure, post closure, and financial violations.

(2) Environmental conditions affecting the satisfactory operation of the facility include violations of state and/or federal laws other than RCRA.

(3) Under limited circumstances, EPA Administrator may allow disposal of hazardous substances at a RCRA facility having significant RCRA violations or other environmental conditions affecting satisfactory operation, providing that the facility owner or operator has entered into a consent order or decree to correct the problems, and disposal only occurs within the facility at a new or existing unit that is in compliance with RCRA requirements.

C. Landfill disposal must be in a unit meeting applicable RCRA minimum technical requirements.

(1) Current RCRA minimum technical requirements for land disposal include the use of a double liner system.

(2) Under limited circumstances (low waste toxicity, mobility, and persistence), EPA may approve the use of a single-lined land disposal

unit for RCRA wastes where use of such a unit adequately protects public health and the environment.

3.03 NON-HAZARDOUS WASTES

A. The facility must have a state permit, if applicable.

B. The facility must be permitted in good legal standing with applicable agency regulatory requirements.

3.04 SAMPLING

A. Perform all sampling and analyses required by the disposal facility at no additional cost to the DEPARTMENT. Provide copies of these results to the ENGINEER.

3.05 REPORTING

A. Once the waste has been permanently disposed of, the Hazardous Waste Manifests shall be completed in accordance with 6 NYCRR Part 372 and returned by the DEPARTMENT. In accordance with 40 CFR 262.42, generator shall contact the transporter and TSD facility to determine the status of the HTW if the manifest is not returned to the generator within 35 days of the date waste was accepted by the initial transporter. The generator shall file an exception report with EPA and GNOSTIC if he has not received a completed copy of the manifest from the designated TSD facility within 45 days of the date the waste was accepted by the original transporter. The CONTRACTOR shall be responsible for providing the generator with the information needed to complete the exception report.

B. Provide Certificates of Disposal for all wastes shipped off site. The Certificates of Disposal shall be submitted to the ENGINEER within 180 days of the shipment of wastes off site.

C. Items and materials that have been recycled or salvaged shall only require a signed bill of lading or receipt of materials and quantity received.

* * * END OF SECTION * * *

POST-EXCAVATION CONFIRMATORY SAMPLING PROCEDURES

ATTACHMENT 1

POST-EXCAVATION CONFIRMATORY SOIL SAMPLING PROCEDURES

This attachment presents procedures used to collect post-excavation confirmatory soil samples, if required, from the Bern Metal/Universal Metals site during remedial action activities. This procedure is provided in the event post-excavation confirmatory samples are required during excavation activities. As presented in the Remedial Design Report, collection of post-excavation confirmatory samples is not anticipated.

Materials

- Stainless steel trowel
- Appropriate sample containers
- Sample coolers or other approved storage/shipping containers
- Distilled water
- Decontamination liquid
- Hard hats
- Safety glasses
- Appropriate PPE (per the HASP)
- Plastic bags

Procedures

1. Identify the soil sampling location in the field log. The soil sampling location will be determined by the on-site engineer and NYSDEC representative. Also indicate the temperature, weather, date, and personnel at the site.

2. Conduct work in accordance with the HASP for the Bern Metal/Universal Metals Site Remedial Design Report.

3. The soil sample will be collected from exposed soils following excavation using a decontaminated stainless steel trowel from 0" to 6" below the exposed soil surface.

4. A labeled and flagged stake denoting the soil boring number will be placed at the soil boring location for inclusion in the site instrument survey.

5. The soil sample will be placed directly into the appropriate containers for subsequent laboratory analysis for total lead using NYSDEC Analytical Services Protocol (ASP) Methods. Sample packing, handling, and shipping procedures are addressed in Attachment 2.

ATTACHMENT 2

SAMPLE PACKING, HANDLING, AND SHIPPING PROCEDURES

This procedure discusses required methodologies of sample packing, handling, and shipping for post-excavation confirmatory soil samples collected from the Bern Metal/Universal Metals site during remedial action activities. These procedures are to be followed, as appropriate, during sample shipment.

I. Handling

1. Fill in sample label with the following information, as appropriate:

   - Sample type (soil, waste, surface water, ground water);
   - Project number and site name;
   - Sample identification code and other sample identification information, if applicable;
   - Analysis required;
   - Date;
   - Time sampled;
   - Name, affiliation, and contact phone number;
   - Sample type (composite or grab); and
   - Preservative added, if applicable.

2. Cover the label with clear packing tape to secure the label onto the container.

3. Check the caps on the sample containers to ensure that they are tightly sealed.

4. Wrap the sample container cap with clear packing tape to prevent it from becoming loose.

6. Place a signed custody seal label over the cap such that the cap cannot be removed without breaking the custody seal (except for VOA vials).

7. Initiate chain-of-custody by designated sampling personnel responsible for sample custody (after sampling or prior to sample packing).

II. Packing

1. Using tape, secure the outside and inside of the drain plug at the bottom of the cooler that is used for sample transport.

2. Place each sample container(s) or package in individual polyethylene bags (Ziploc®-type) and seal. For VOA vials, place custody seals around the bags.

3. Place vermiculite (or equivalent) at the bottom of the cooler as a cushioning material.

4. Package the sealed sample containers upright in the cooler.

5. Repackage ice (if required) in small Ziploc®-type plastic bags and place loosely in the cooler. Do not pack ice so tightly that it may prevent addition of sufficient cushioning material.

6. Fill the remaining space in the cooler with vermiculite (or equivalent).

7. Place the completed chain-of-custody forms in a large Ziploc®-type bag and tape the forms to the inside of the cooler lid.

8. Close the lid of the cooler and fasten with tape.

9. Wrap tape around both ends of the cooler at least twice.

10. Mark the cooler on the outside with the following information: shipping address, return address, "Fragile" labels on the top and on one side, and arrows indicating "This Side Up" on two adjacent sides.

11. Place custody seal evidence tape over front right and back left of the cooler lid and cover with clear plastic tape.

III. Shipping

1. All samples will be hand delivered or delivered by an express carrier within 48 hours from the date of sample collection.

2. The following chain-of-custody procedures will apply to sample shipping:

   a. Relinquish the sample containers to the laboratory via express carrier. The signed and dated forms should be included in the cooler. The express carrier will not be required to sign the chain-of-custody forms. The sampler should retain the express carrier receipt or bill of lading.

   b. When the samples are received by the laboratory, the laboratory personnel shall complete the chain-of-custody forms by recording receipt of samples, measure and record the internal temperature of the shipping container, and then check the sample identification numbers on the containers to the chain-of-custody forms.

ATTACHMENT 3

EQUIPMENT DECONTAMINATION AND CLEANING PROCEDURES

I. Introduction

This attachment presents procedures which will be used to decontaminate equipment used to collect soil, sediment, and ground-water samples. The adequacy of cleaning procedures will be monitored through the collection of QA/QC rinse blank samples which will be submitted for laboratory analysis.

II.. Equipment Decontamination

The equipment to be used for the collection of soil samples (i.e., trowels, shovels, etc.) will be decontaminated prior to each use to mitigate the potential for cross-contamination of the samples. The decontamination procedure to be utilized for samples will include the following steps:

- Non-phosphate detergent solution wash;
- Distilled water rinse;
- 10% Nitric acid rinse;
- Distilled water rinse; and
- Allow to air-dry.

Spent decontamination liquids will be controlled, collected, and containerized for appropriate disposition.

Appendix A

Appendix A

Health and Safety Plan for Excavation and Capping Activities

Bern Metal/Universal Sites
(Site No. 915135)
Buffalo, New York

September 1998

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

30 Corporate Woods, Suite 160
Rochester, New York 14623-1477
(716) 292-6740

Approvals and Acknowledgments

Approvals

I have read and approved this HASP with respect to project hazards, regulatory requirements, and BBL procedures.

Project Name: Bern Metal/Universal Sites PRP Group: Excavation and Capping Activities Project Number: 778.03

Project Manager/Date

Regional Health and Safety Coordinator/Date

Project/Site HS Staff/Date

Acknowledgments

The final approved version of this HASP has been provided to the Site Supervisor. I acknowledge my responsibility to provide the Site Supervisor with the equipment, materials and qualified personnel to implement fully all safety requirements in this HASP. I will formally review this plan with the HS Staff every six months until project completion.

Project Manager

Date

I acknowledge receipt of this HASP from the Project Manager, and that it is my responsibility to explain its contents to all site personnel and cause these requirements to be fully implemented. Any change in conditions, scope of work, or other change that might affect worker safety requires me to notify the Project Manager and/or the Health and Safety Representative.

Site Supervisor

Date

Health and Safety Plan Acknowledgment

I have read this Site-Specific Health and Safety Plan, or its contents have been presented to me, and I understand the contents, and I agree to abide by its requirements.

Name (Print)	Signature	Representing	Date

Table of Contents

B	29 CFR 1926 Subpart P: Appendix A
C	BBL Confined Space Entry PPM
D	Underground/Overhead Utilities Checklist
E	Material Safety Data Sheets
F	Daily Air Monitoring Log
G	BBL Daily Safety Meeting Log
H	Accident Investigation Report

Section 1

1. Introduction

1.1 Objective

The purpose of the project is to implement site activities, including the following components:

- Mobilization;
- Soil Excavation and Backfilling;
- Landfill Cap Construction;
- Cap Maintenance Activities;
- Groundwater Monitoring Well Installation;
- Groundwater Sampling; and
- Equipment Cleaning/Demobilization.

The objective of this plan is to provide a mechanism for establishing safe working conditions at the site. The safety organization, procedures, and protective equipment have been established based on an analysis of potential physical, chemical, and biological hazards. Specific hazard control methodologies have been evaluated and selected to minimize the potential of accident or injury.

1.2 Site and Facility Description

The site is located in Buffalo, New York. A detailed site history and description is provided in Remedial Investigation Report, Bern Metal/Universal Sites, Buffalo, New York, November 1995, prepared by Blasland, Bouck & Lee, Inc. (BBL).

1.3 Policy Statement

The policy of Blasland, Bouck & Lee, Inc. (BBL) is to provide a safe and healthful work environment for all employees. No aspect of operations is of greater importance than injury and illness prevention. A fundamental principle of safety is that all accidents and injuries are preventable. BBL will take every reasonable step to eliminate or control hazards in order to minimize the possibility of injury, illness, or accident.

This Health and Safety Plan (HASP) prescribes the procedures that must be followed during activities at the Bern Metal/Universal Site. Operational changes that could affect the health and safety of personnel, the community, or the environment will not be made without the prior approval of the Project Manager (PM) and the Health and Safety Representative. This document will be periodically reviewed to ensure that it is current and technically correct. Any changes in site conditions and/or the scope of work will require a review and modification to the HASP. Such changes will be completed in the form of an addendum to this plan or a revision of the plan.

The provisions of this plan are mandatory for all BBL personnel and BBL's subcontractors assigned to the project. All visitors to the work site must also abide by the requirements of the plan. It should be acknowledged that the employees of other consulting and/or contracted companies may work in accordance with their own independent HASPs. Subcontractor HASPs, if prepared, must meet the requirements of this HASP.

1.4 References

This HASP complies with applicable Occupational Safety and Health Administration (OSHA) regulations, United States Environmental Protection Agency (USEPA) regulations, and BBL Health and Safety policies and procedures. This plan follows the guidelines established in the following:

- *Standard Operating Safety Guides*, USEPA (Publication 9285.1-03, June 1992).
- *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, NIOSH, OSHA, USCG, USEPA (86-116, October 1985).
- Title 29 of the Code of Federal Regulations (CFR), Part 1910.120.
- Title 29 of the Code of Federal Regulations (CFR), Part 1926.
- *Pocket Guide to Chemical Hazards*, DHHS, PHS, CDC, NIOSH (1994).
- *Threshold Limit Values*, ACGIH (1995).
- *Quick Selection Guide to Chemical Protective Clothing*, Forsberg, K. and S.Z. Mansdorf, 2nd Ed. (1993).
- *Health and Safety Policies and Procedures Manual*, BBL.

In addition, this HASP is based upon information provided in the Soil Sampling and Analysis Final Report, September 1991, Soil Sampling Berns Metal/Universal Metals Site Final Report, October 1990, prepared by Roy F. Weston, Inc., and Remedial Investigation Report, Bern Metal/Universal Sites, Buffalo, New York, November 1995, prepared by Blasland, Bouck & Lee, Inc. (BBL).

1.5 Definitions

The following definitions are applicable to this HASP:

- ***Site*** - the area where the work is to be performed by BBL personnel. The site includes the EZ, CRZ, and SZ.
- ***Project*** - all on-site work performed under the scope of work.
- ***Subcontractor*** - includes subcontractor personnel hired by BBL.
- ***On-Site Personnel*** - all PRP group personnel, BBL, and subcontractor personnel directly involved with the project.
- ***Visitor*** - all other personnel, except the on-site personnel. All visitors must receive approval to enter the site.
- ***Exclusion Zone (EZ)*** - any portion of the site where hazardous substances are, or are reasonably suspected to be, present in the air, water, or soil.
- ***Contamination Reduction Zone (CRZ)*** - area between the Exclusion Zone and Support Zone that provides a transition between contaminated and clean areas. Decontamination stations are located in this zone.

- ***Support Zone (SZ)*** - all areas of the site excluding the EZ and CRZ. The SZ surrounds the immediate area where project activities are underway. Support equipment is located in this zone.

Section 2

2. Roles and Responsibilities

2.1 All Personnel

All BBL and subcontractor personnel must adhere to these procedures during the performance of their work. Each person is responsible for completing tasks safely and reporting any unsafe acts or conditions to his or her immediate supervisor or to the Site Supervisor (SS). No person may work in a manner that conflicts with these procedures. After due warnings, the PM will dismiss from the site any person who violates safety procedures.

All on-site personnel will receive training in accordance with 29 CFR 1910.120, and be familiar with the requirements and procedures contained in this document prior to the beginning of project operations.

The roles of key BBL personnel are outlined in the following sections. Key personnel and contacts are summarized in Table 2.1.

2.2 Health and Safety Specialist (HSS)

The project HSS is responsible for technical health and safety aspects of the project, including preparation, review, and approval of this HASP. Inquiries regarding BBL procedures, project procedures, and other technical or regulatory issues should be addressed to this individual. Any changes or addenda to this HASP must be approved by the HSS, who is also responsible for coordinating on site health and safety issues. The HSS will advise the PM on health and safety issues and will establish and oversee the project air monitoring program. The HSS is the primary site contact on occupational health and safety matters.

It is the responsibility of the HSS or designated alternate to:

- Provide on-site technical assistance, if necessary;
- Conduct site and personal air monitoring, including equipment maintenance and calibration. Where necessary, submit samples to an American Industrial Hygiene Association (AIHA) accredited laboratory;
- Prepare material for site safety orientation training and daily safety meetings;
- Verify that on-site personnel have received the required physical examinations and medical certifications;
- Review site activities with respect to compliance with the HASP;
- Maintain required health and safety documents and records; and
- Assist, if necessary, the Site Supervisor (SS) in the instruction of field personnel on the hazards and equipment procedures required.

2.3 Project Manager

The PM is ultimately responsible for verifying that all project activities are completed in accordance with the requirements and procedures in this plan. The PM is responsible to provide the Site Supervisor (SS) with the equipment, materials, and qualified personnel to implement fully all safety requirements in this HASP.

It is the responsibility of the PM to:

- Review safety inspection reports;
- Thoroughly investigate all accidents and incidents on the project;
- Approve, in writing, addenda or modifications of this HASP; and
- Suspend work if health- and/or safety-related concerns arise.

2.4 Site Supervisor

The SS is responsible for implementation of the HASP, including communication of site requirements to all on-site project personnel (including subcontractors). The SS will be responsible for informing the PM of any changes in the work plan or procedures so that those changes may be addressed in the HASP. Other responsibilities include:

- Consultation with the HSS on site safety and health issues;
- Conducting a daily safety inspection of the site and completing a weekly inspection form (Attachment A);
- Stopping work, as required, to ensure personal safety and protection of property, or in cases of life- or property-threatening safety non-compliance;
- Obtaining a site map and determining and posting routes to medical facilities and emergency telephone numbers, and arranging emergency transportation to medical facilities;
- Notifying local public emergency officers of the nature of the site operations and posting of their telephone numbers in an appropriate location;
- Observing on-site project personnel for signs of chemical or physical trauma;
- Verifying that all site personnel have the proper medical clearance, have met applicable training requirements, and have training documentation available in the office;
- Verifying that all on-site personnel are made aware of the provisions of the HASP and have been informed of the nature of any physical, chemical, and biological hazards associated with the site activities;
- Verifying that on-site personnel and visitors have received the required training, including instructions for safety equipment and personal protective equipment (PPE) use;
- Suspending work if health- and/or safety-related concerns arise; and
- Issuing/obtaining required work permits.

2.5 Subcontractors

On-site subcontractors and their personnel must understand and comply with the site requirements established in this HASP. Subcontractors may prepare their own task-specific HASPs, which must be consistent with the

requirements of this HASP. Subcontractor personnel must attend and participate in the Daily Safety Meetings and all other site safety meetings.

2.6 On-Site Personnel and Visitors

All personnel must read and acknowledge their understanding of this HASP, abide by the requirements of the plan, and cooperate with site supervision in ensuring a safe work site. Site personnel will immediately report any of the following to the SS or HSS:

- Accidents and injuries, no matter how minor;
- Unexpected or uncontrolled release of chemical substances;
- Symptoms of chemical exposure;
- Unsafe or malfunctioning equipment;
- Changes in site conditions that may affect the health and safety of project personnel;
- Damage to equipment or property; and
- Situations or activities for which they are not properly trained.

TABLE 2-1
KEY PERSONNEL

Blasland, Bouck & Lee, Inc. Personnel		
Role	**Name**	**Address/Telephone No.**
Project Manager	Lowell W. McBurney, P.E.	6723 Towpath Rd., Box 66 Syracuse, NY 13214 (315) 446-9120
Corporate Health and Safety Associate	Jay D. Keough, CIH	8 South River Road Cranbury, NJ 08512 (609) 860-0590
Regional Health and Safety Coordinator	Herrick L. Teeter Jr., CIH	6723 Towpath Rd., Box 66 Syracuse, NY 13214 (315) 446-9120
Task Manager	Douglas M. Ruszczyk	30 Corporate Woods, Suite 160 Rochester, NY 14623 (716) 292-6740
Health and Safety Specialist	Michael R. Arlauckas	30 Corporate Woods, Suite 160 Rochester, NY 14623 (716) 292-6740
Key Contractor Personnel		
Company	**Name**	**Telephone**
TBD		
Key Agency Personnel		
Agency	**Name/Title**	**Address/Telephone**
NYSDEC	Vivek Nattanmai, Project Manager	Hazardous Waste Remediation NYSDEC 50 Wolf Road, Room 212 Albany, NY 12233-7010 (518) 474-2121
NYSDOH	Richard Tuers, Sanitary Engineer	Bureau of Environmental Exposure Investigation NYSDOH 11 University Place, Room 205 Albany, NY 12203 (518) 458-6309

Section 3

3. Project Hazards and Control Measures

3.1 Scope of Work

The scope of work includes the following field activities:

- Mobilization;
- Soil Excavation and Backfilling;
- Landfill Cap Construction;
- Cap Maintenance Activities;
- Groundwater Monitoring Well Installation;
- Groundwater Sampling; and
- Equipment Cleaning/Demobilization.

3.1.1 Job Hazard Assessment

The following job hazard assessment identifies potential safety, health, and environmental hazards associated with each type of field activity. Because of the complex and changing nature of field projects, supervisors must continually inspect the work site to identify hazards that may affect site personnel, the community, or the environment. The SS must be aware of these changing conditions and discuss them with the PM whenever these changes impact employee health, safety, the environment, or performance of the project. The SS will keep BBL personnel and subcontractors informed of the changing conditions, and the PM will write or approve addenda or revisions to this HASP as necessary.

3.2 Field Activities, Hazards, Control Procedures

The following sections present the hazards and safety procedures for activities outlined in the scope of work for the site. Specific activities may be grouped into sections with other activities based on similar hazards and safety precautions for the activities.

3.2.1 Excavation Activities

Excavation activities may involve a potential for exposure to physical and health hazards. Hazards may be associated with the site and the environmental conditions.

Physical Hazards: The physical hazards involved in the excavation of soils are related to the excavation itself and the operation of heavy equipment. The presence of overhead utilities such as power lines requires careful positioning of the excavating equipment in order to maintain a safe distance between the lines and the closest part of the equipment. The presence of underground utilities such as gas lines, power lines, water lines and sewer pipes must be determined prior to beginning the excavation.

Working Surfaces: Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, and slips and falls. All personnel should frequently inspect working surfaces and keep working surface clear of debris.

*Materials **Handling**:* The most common type of accident that occurs in material handling operations is the "caught between" situation when a load is being handled and a finger or toe gets caught between two objects. Extreme care must be taken when loading and unloading material. Proper lifting technique must be employed.

Control: Prior to initiating activity, the site conditions will be discussed with all employees. Hazards will be identified and protective measures will be explained. Equipment will be inspected and in proper working condition. Mechanical assistance should be provided for large lifting tasks. Avoidance of biological hazards as discussed in Section 4 will be implemented. BBL and BBL subcontractor personnel will be working near or in excavation areas. The following sections discuss excavation safety procedures for BBL and BBL subcontractor personnel.

3.2.2 Excavation Safety

During soil removal activities BBL and BBL subcontractor personnel will be working in areas of active excavation. Excavation involves removing earthen materials from a designated area, thereby creating a man-made cut, trench, or depression in the earth's surface.

Excavations pose significant hazards to employees if they are not carefully controlled. There exists a chance for the excavation to collapse if it is not dug properly, sloped, benched or shored as required by 29 CFR 1926 Subpart P. Protective systems, as required by 29 CFR 1926 Subpart P, must be utilized if the potential for hazardous cave-ins exist. The excavation also is a fall hazard, and employees must pay careful attention to what they are doing or they risk a fall into the excavation. Fall protection, as required by 29 CFR 1926 Subpart M, will be required.

Some activities may require personnel to enter an excavation. Whenever feasible, equipment placement and other activities shall be done remotely, without entering the excavation. If entry is absolutely unavoidable, the safety procedures for excavation entry and employee protective systems consistent with 29 CFR 1926 Subpart P shall be followed for each such activity. Air monitoring in accordance with Section 8 is required for all excavation entry activities.

Noise also may present a hazard. Heavy equipment operation frequently results in noise levels exceeding 85 dBA, requiring the use of hearing protection.

*Chemical **Hazards**:* Airborne concentrations of soil contaminants and the dust from the procedure pose the potential for exposure at this stage.

Control: Before any digging can be done, all underground utilities must be located and identified. PPE for the excavation and soil sampling work will initially consist of Modified Level D. The level of protection may be adjusted as necessary depending on the results of air monitoring as described in Section F.

All excavation activities shall be conducted in accordance with 29 CFR 1926 Subpart P. As indicated above, any personnel entry into an excavation will be in accordance with 29 CFR 1926 Subpart P. If excavation operations are located near underground installations, the exact location of the installations must be determined by safe and acceptable means. While the excavation is open, underground installations must be protected, supported or removed as necessary to safeguard employees.

3.2.2.1 Asphalt Removal Prior to Excavation

This task involves cutting pavement with a saw and removing the pieces with heavy equipment. Employees are exposed to several physical hazards while cutting and removing asphalt. The primary hazard is cuts, punctures or abrasions resulting from the cutting of the asphalt as the saw blade penetrates the asphalt surface. High speed saws tend to hurl pieces of material at high rates of speed that can cause serious injury to unprotected areas of the body.

Serious injury or death can result if an employee makes contact with the rotating saw blades. Cuts or possible amputation are the likely results of this contact. Only properly trained and supervised employees are permitted to operate the saw.

Noise is a significant hazard during this operation. Hand operated power saws generate noise exceeding 85 decibels, and therefore require hearing protection. Heavy equipment operation frequently results in noise levels which exceed 85 dBA, requiring the use of hearing protection as well. Exposure to high levels of noise for a sufficient period of time may result in loss of hearing in certain frequencies.

The most likely hazard is airborne concentrations of the dust from the cutting procedure. The dust may pose a health hazard, and PPE may be necessary to protect employees from exposure.

Control: All personnel shall wear hearing protection during this phase of the operation, unless monitoring has been done to determine the areas where the noise level is less than 85 dBA. Personnel operating the saw must wear the PPE described in Section 5.0. This section also describes the PPE for other personnel. Only the personnel using the saw are permitted within 25 feet of the cutting area until the saw has stopped operating.

3.2.2.2 Excavation Access, Egress, and General Requirements

Structural ramps that are used solely by employees as a means of access or egress from excavations must be designed by a competent person. Structural ramps used for access or egress of equipment must be designed by a competent person qualified in structural design, and must be constructed in accordance with the design. Ramps and runways constructed of two or more structural members must have the structural members connected together to prevent displacement. Structural members used for ramps and runways must be of uniform thickness. Cleats or other appropriate means used to connect runway structural members must be attached to the bottom of the runway or must be attached in a manner to prevent tripping. Structural ramps used in lieu of steps must be provided with cleats or other surface treatments to the top surface to prevent slipping.

A stairway, ladder, ramp or other safe means of egress must be located in trench excavations that are 4 feet (1.22 m) or more in depth, so as to require no more than 25 feet (7.62 m) of lateral travel for employees.

No person shall be permitted underneath loads handled by lifting or digging equipment. Site personnel must be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped, in accordance with 1926.601(b)(6), to provide adequate protection for the operator during loading and unloading operations.

When mobile equipment is operated adjacent to an excavation, or when such equipment is required to approach the edge of an excavation, and the operator does not have a clear and direct view of the edge of the excavation,

a warning system must be utilized such as barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.

In addition to the requirements set forth in 29 CFR 1926.50 - 1926.107 to prevent exposure to harmful levels of atmospheric contaminants and to assure acceptable atmospheric conditions, the following requirements must apply: Where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist, such as in excavations in landfill areas or excavations in areas where hazardous substances are stored nearby, the atmospheres in the excavation must be tested before employees enter excavations.

Adequate precautions must be taken to prevent employee exposure to atmospheres containing less than 19.5 percent oxygen and other hazardous atmospheres. These precautions include providing proper respiratory protection or ventilation in accordance with 29 CFR 1926.50 - 1926.107.

Adequate precaution must be taken such as providing ventilation, to prevent employee exposure to an atmosphere containing a concentration of a flammable gas in excess of 10 percent of the lower flammable limit of the gas.

When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, testing must be conducted as often as necessary to ensure that the atmosphere remains safe.

Emergency rescue equipment, such as breathing apparatus, a safety harness and line, or a basket stretcher, must be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation. This equipment must be attended by support personnel when in use.

Employees must not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline. If water is controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations must be monitored by a competent person to ensure proper operation.

If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches, dikes, or other suitable means must be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will require an inspection by a competent person.

Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning must be provided to ensure the stability of such structures for the protection of employees. Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees is not permitted except when:

- A support system designed by a competent person, such as underpinning, is provided to ensure the safety of employees and the stability of the structure; or
- The excavation is in stable rock; or

- A registered professional engineer has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity; or

- A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

Sidewalks, pavements and appurtenant structures must not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures. Adequate protection must be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection must consist of scaling to remove loose material; installation of protective barricades at intervals as necessary on the face to stop and contain falling material; or other means that provide equivalent protection.

Employees must be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection must be provided by placing and keeping such materials or equipment at least 2 feet (.61 m) from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

Dust Control - Airborne particulate generation will be controlled during site excavations. Dry, dusty soil will be wetted with a water spray from a potable water source to control the generation of dust. Soil will not be wetted to a degree which will cause runoff or soil erosion.

Walkways must be provided where employees or equipment are required or permitted to cross over excavations. Guardrails which comply with 1926.502(b) must be provided where walkways are 6 feet (1.8 m) or more above lower levels. Adequate barrier protection must be provided at all remotely located excavations. All wells, pits, shafts, etc., must be barricaded or covered. Upon completion of exploration and other similar operations, temporary wells, pits, shafts, etc., must be backfilled.

3.2.2.3 Inspections by Competent Person

Daily inspections of excavations, the adjacent areas, and protective systems must be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection must be conducted by the competent person prior to the start of work and as needed throughout the shift. Inspections also must be made after every rainstorm or other hazard increasing occurrence. These inspections are only required when employee exposure can be reasonably anticipated. Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees must be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

3.2.2.4 Soil Classification

29 CFR 1926 Subpart P, Appendix A (Attachment B) describes methods of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits. The appendix contains definitions, sets forth requirements, and describes acceptable visual and manual tests for use in classifying soils. This appendix applies when a sloping or benching system is designed in accordance with the requirements set forth in 1926.652(b)(2) as a method of protection for employees from cave-ins. This

appendix also applies when timber shoring for excavations is designed as a method of protection from cave-ins in accordance with Appendix C to Subpart P of part 1926, and when aluminum hydraulic shoring is designed in accordance with 29 CFR Subpart P Appendix D. Appendix D also applies if other protective systems are designed and selected for use from data prepared in accordance with the requirements set forth in 1926.652(c), and the use of the data are predicated on the use of the soil classification system set forth in Appendix A.

Maximum allowable slope means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V). Short term exposure means a period of time less than or equal to 24 hours that an excavation is open. Soil and rock deposits must be classified in accordance with Appendix A to Subpart P of part 1926. The maximum allowable slope for a soil or rock deposit must be determined from Table B-1. The actual slope must not be steeper than the maximum allowable slope. The actual slope must be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope must be cut back to an actual slope which is at least ½ horizontal to one vertical (1/2H:1V) less steep than the maximum allowable slope. When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person must determine the degree to which the actual slope must be reduced below the maximum allowable slope, and must assure that such reduction is achieved. Surcharge loads from adjacent structures must be evaluated in accordance with 1926.651(I). Configurations of sloping and benching systems must be in accordance with 29 CFR 1926 Subpart P Appendix B.

TABLE B-1
29 CFR 1926 Subpart P Appendix B
MAXIMUM ALLOWABLE SLOPES

SOIL OR ROCK TYPE	MAXIMUM ALLOWABLE SLOPES (H:V)(1) FOR EXCAVATIONS LESS THAN 20 FEET DEEP(3)
STABLE ROCK	VERTICAL (90 Deg.)
TYPE A (2)	3/4:1 (53 Deg.)
TYPE B	1:1 (45 Deg.)
TYPE C	1 1/2:1 (34 Deg.)

Footnote(1) Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.

Footnote(2) A short-term maximum allowable slope of 1/2H:1V (63 degrees) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth must be 3/4H:1V (53 degrees).

Footnote(3) Sloping or benching for excavations greater than 20 feet deep must be designed by a registered professional engineer.

3.2.2.5 Overhead Electrical Clearances

If excavation is conducted in the vicinity of overhead power lines, the power to the lines must be shut off or the equipment must be positioned such that no part, including excavation boom can come within the minimum clearances as follows:

Nominal System Voltage	Minimum Required Clearance
0-50kV	10 feet
51-100kV	12 feet
101-200kV	15 feet
201-300kV	20 feet
301-500kV	25 feet
501-750kV	35 feet
751-1,000kV	45 feet

When the equipment is in transit, with the boom lowered and no load, the equipment clearance must be at least 4 feet for voltages less than 50kV, 10 feet for voltages of 50 kV to 345 kV, and 16 feet for voltages above 345 kV.

3.2.3 Heavy Equipment Materials Handling/Backfilling

To protect all on-site personnel against hazards associated with materials handling, and to prevent injury due to unsafe heavy equipment operation, only properly trained and authorized operators will be allowed to operate heavy equipment. All materials handling equipment will be maintained in safe operating condition and inspected daily prior to use.

3.2.3.1 Haulage Roadways/Traffic Safety

Single-lane private roads with two-way traffic shall be provided with turnouts. Where turnouts are not practical, a control system shall be provided to prevent vehicles from meeting on such single-lane roads. On private roads used for two-way traffic, arrangements shall be such that vehicles travel on the right side as much as possible. Signs shall be posted to clearly indicate variations from this system. Where practicable, separate haulage roads shall be provided between loaded and empty units. Haulage roads shall be wide enough to allow for safe passage. Safe distances between moving units shall be maintained. Private roads shall be maintained free from holes and ruts that affect the safe control of the vehicle. Every emergency access ramp and berm used by an employer shall be constructed to restrain and control runaway vehicles. Where a hazard exists to employees because of traffic or haulage conditions, a system of traffic controls shall be required so as to abate the hazard.

Employees, such as grade-checkers, surveyors and others exposed to vehicular traffic, shall wear flagging garments, or equivalent, as required for flaggers.

Equipment shall be under control at all times and shall be kept in gear when descending grades. No vehicle shall be driven at a speed greater than is reasonable and proper, with due regard for weather, traffic, intersections, width and character of the roadway, type of motor vehicle, and any other existing conditions.

3.2.3.2 Equipment Construction/Safety Features

Arrangements shall be made to direct exhaust gases away from the operator's breathing zone. When push-tractors are working in tandem, heat shields, or equivalent protection, shall be provided for operators.

Windshields complying with the applicable provisions of the Vehicle Code shall be provided and maintained on haulage vehicles and scrapers. Equipment and accessories installed on haulage vehicles shall be arranged so as to avoid impairing the driver's operational vision to the front or sides.

Service brake systems for self-propelled, rubber-tired, off-highway equipment manufactured before January 1, 1972 (for scrapers January 1, 1971) shall meet minimum performance criteria for service brake systems as set forth in the Society of Automotive Engineers Recommended Practices listed below. Service, emergency and parking brake systems for self-propelled, rubber-tired, off-highway equipment manufactured after January 1, 1972 (for scrapers January 1, 1971) shall meet the applicable minimum performance criteria for each system as set forth in the same Society of Automotive Engineers Recommended Practices:

Self-Propelled Graders	SAE J236-1971
Trucks and Wagons	SAE J166-1971
Front-End Loaders & Dozers	SAE J237-1971
Self-Propelled Scrapers	SAE J319b-1971

Haulage vehicles, whose pay load is loaded by means of cranes, power shovels, loaders, or similar equipment, shall have a cab shield and/or canopy adequate to protect the operator from shifting or falling materials. Whenever visibility conditions warrant additional light, all vehicles, or combinations of vehicles, in use shall be equipped with at least two headlights and two taillights in operable condition.

Crawler tractors, bulldozers, carryalls and similar equipment manufactured and used prior to April 1, 1971, except for scrapers, front-end loaders and new equipment, shall have canopy protection and seat belts for the operator when used where there is exposure to falling or rolling objects.

Operating levers controlling hoisting or dumping devices on haulage bodies shall be equipped with a latch or other device which will prevent accidental starting or tripping of the mechanism. Trip handles for tailgates of dump trucks shall be so arranged that in dumping, the operator will not be exposed either to the hazard of being struck by falling material or any part of the truck. Haulage vehicles equipped with dump bodies that tilt to release their load by gravity through an opening at the rear or side shall be provided with a device that gives the operator a clearly audible or visible warning when sufficient force is applied by the elevating mechanism to cause or sustain dump body elevation.

Tractor-scrapers (self-propelled) pushed by other equipment during loading operations shall be provided with a clearly audible or visible warning device that can be activated by the operator of the tractor-scraper to communicate an "ALL STOP" warning to the pushing equipment in event of an emergency. Roll over protective structures (ROPS) and seat belts shall be installed and used on all equipment in accordance with 29 CFR 1926 Subpart W.

Vehicles with cabs shall have windshields and powered windshield wipers. Cracked or broken windshields shall be replaced promptly. Where fogging or frosting of windshields is prevalent, defogging or defrosting equipment shall be required. Tools and material shall be secured to prevent movement when transported in the same compartment with employees.

Vehicles used to transport employees shall have seats firmly secured and adequate for the number of employees to be carried.

Where vehicles are operated, temporary covers for conduits, trenches and manholes and their supports, when located in roadways and vehicular aisles, shall be designed to carry at least 2 times the maximum intended vehicular live load and they shall be designed and installed as to prevent accidental displacement.

3.2.3.3 Audible Alarms

Every vehicle used to haul dirt, rock, concrete, or other construction material shall be equipped with a warning device that operates automatically while the vehicle is backing. The warning sound shall be of such magnitude that it will normally be audible from a distance of 200 feet and will sound immediately on backing. In congested areas or areas with high ambient noise which obscures the audible alarm, a signaler, in clear view of the operator, shall direct the backing operation. Other vehicles, if operating in areas where their backward movement would constitute a hazard to employees working in the area on foot, and where the operator's vision is obstructed to the rear of the vehicle shall be equipped with an effective device or method to safeguard employees such as:

(1) An automatic back-up audible alarm which would sound immediately on backing, or

(2) An automatic braking device at the rear of the vehicle that will apply the service brake immediately on contact with any obstruction to the rear, or

(3) In lieu of 1 or 2 above, administrative controls shall be established such as:

(A) A spotter or flagger in clear view of the operator who shall direct the backing operation,

(B) Other procedures which will require the operator to dismount and circle the vehicle immediately prior to starting a back-up operation, or

(C) Prohibiting all foot traffic in the work area.

(4) Other means shall be provided that will furnish safety equivalent to the foregoing for personnel working in the area.

All vehicles shall be equipped with a manually operated warning device which can be clearly heard from a distance of 200 feet. The operator of all vehicles shall not leave the controls of the vehicle while it is moving under its own engine power. Hauling or earth moving operations shall be controlled in such a manner as to ensure that equipment or vehicle operators know of the presence of rootpickers, spotters, lab technicians, surveyors, or other workers on foot in the areas of their operations.

3.2.3.4 Wire Rope Use

When wire rope is being wound on a power-driven drum, a mechanical threading device shall be used, where practicable, to guide the cable. When this operation must be done manually, the feet shall not be used and the hands shall be kept at least 3 feet from the drum.

3.2.3.5 Equipment Inspection and Maintenance

All vehicles in use shall be checked at the beginning of each shift to assure that the following parts, equipment, and accessories are in safe operating condition and free of apparent damage that could cause failure while in use: service brakes, including trailer brake connections; parking system (hand brake); emergency stopping system (brake); tires; horn; steering mechanism; coupling devices; seat belts; operating controls; and safety devices. All defects affecting safe operation shall be corrected before the vehicle is placed in service. These requirements also apply to equipment such as lights, reflectors, windshield wipers, defrosters, fire extinguishers, etc., where such equipment is necessary.

Vehicle engines shall not be allowed to run in closed garages or other enclosed places, unless vents are provided which effectively remove the exhaust gases from the building.

Except for emergency field repairs, a safety tire rack, cage, or equivalent protection shall be used when inflating truck or equipment tires after mounting on a rim, if such tires depend upon a locking ring or similar device to hold them on the rim.

No repairs shall be attempted on power equipment until arrangements are made to eliminate possibility of injury, caused by sudden movements or operation of the equipment or its parts. When the equipment being repaired is a bulldozer, carryall, ripper, or other machine having sharp or heavy moving parts such as blades, beds, or gates, such parts shall be lowered to the ground or securely and positively blocked in an inoperative position.

All controls shall be in a neutral position, with the engine(s) stopped and brakes set, unless work being performed requires otherwise. Trucks with dump bodies shall be equipped with positive means of support, permanently attached, and capable of being locked in position to prevent accidental lowering of the body while maintenance or inspection work is being done. In all cases where the body is raised for any work, the locking device shall be used.

3.2.3.6 Equipment Parking and Loading

Whenever the equipment is parked, the parking brake shall be set. Equipment parked on inclines shall have the wheels chocked and the parking brake set or be otherwise prevented from moving by effective mechanical means.

Scissor points on all front-end loaders which constitute a hazard to the operator shall be adequately guarded. A loader shall not travel without adequate visibility for the driver and stability of the equipment. No loading device shall be left unattended until the load or bucket is lowered to the ground, unless proper precautions such as blocking are taken to prevent accidental lowering.

3.2.3.7 Equipment Fueling

No internal combustion engine fuel tank shall be refilled with a flammable liquid while the engine is running. Fueling shall be done in such a manner that the likelihood of spillage is minimal. If a spill occurs it shall be contained and cleaned, or equivalent action taken to control vapors before restarting the engine. Fuel tank caps shall be replaced before starting the engine.

A good metal-to-metal contact shall be kept between fuel supply tank or nozzle of supply hose and the fuel tank. No open lights, welding, or sparking equipment shall be used near internal combustion equipment being fueled or near storage tanks. No smoking shall be permitted at or near the gasoline storage area or on equipment being fueled. Post a conspicuous sign in each fuel storage and fueling area stating: "NO SMOKING WITHIN 50 FEET." Class I liquids shall not be dispensed by pressure from drums, barrels, and similar containers. Approved pumps taking suction through the top of the container or approved self-closing faucets shall be used. No repairs shall be made to equipment while it is being fueled.

Each fuel storage tank or drum shall have the word "Flammable" conspicuously marked thereon and should also have a similarly sized word indicating the contents of the container. A fire extinguisher rated 20:BC or larger shall be in a location accessible to the fueling area.

3.2.3.8 Flaggers

Flaggers shall be utilized at locations on a construction site where barricades and warning signs cannot control the moving traffic. When flaggers are required, they shall be placed in relation to the equipment or operation so as to give effective warning. Placement of warning signs shall be according to the State Department of Transportation (DOT). Flaggers shall wear orange warning garments such as vests, jackets, or shirts. Rainwear, when worn, shall be orange, or other color provided an orange outer warning garment is worn. During the hours of darkness, flaggers' stations shall be illuminated such that the flagger will be clearly visible to approaching traffic and flaggers shall be outfitted with reflectorized garments. The retro reflective material shall be either orange, white (including silver-coated reflecting coatings or elements that reflect white light), yellow, fluorescent red-orange, or fluorescent yellow-orange.

Flaggers shall be trained in the proper fundamentals of flagging moving traffic before being assigned as flaggers. Signaling directions used by flaggers shall conform to the DOT standards.

3.2.3.9 Additional Safety Requirements

Additional general heavy equipment safety requirements include, but are not limited to:

- Prior to operating any heavy equipment, the authorized operator must conduct a pre-operation inspection to determine if the heavy equipment is in safe operating condition prior to each work shift;
- All mobile equipment will be equipped with an audible back-up alarm;
- Personnel will not be allowed to stand or pass under the elevated portion of any heavy equipment, whether loaded or empty;
- Personnel will not place arms or legs between pinch or scissors points of the equipment or outside the operator enclosure;
- A safe distance will be maintained from the edge of excavations, ditches, ramps, or platforms;
- Operators will maintain sufficient headroom under overhead utilities; installations, lights, pipes, sprinkler systems, etc.;
- Heavy equipment must never be used for lifting or transporting personnel unless specifically designed for that purpose;
- The operator is required to look in the direction of, and maintain a clear view of the path of travel;
- Heavy equipments will not be operated without an overhead guard and roll-over protection to protect the operator against falling objects and roll-over;
- Heavy equipment must not be driven up to anyone standing in front of any object;
- Stunt driving and horseplay are strictly prohibited;
- Operators will yield the right-of-way to other site vehicles;
- Other heavy equipment traveling in the same direction, at intersections, blind spots, or other dangerous locations must not be passed;
- A safe distance will be maintained from other heavy equipment, and the equipment must be kept under control at all times;
- Heavy equipment operators must slow down for wet and slippery conditions. Under all travel conditions the equipment will be operated at a speed that will permit it to be brought to a stop in a safe manner;
- Operators will avoid running over loose objects on operating surfaces;
- Grades or ramps must be ascended or descended slowly.
- On all grades the load will be tilted back, and raised only as far as necessary to clear the operating surface;
- The operator will slow down and sound the horn at intersections, entering buildings, and other locations where vision may be obstructed;

- If the load being carried obstructs forward view, the operator will travel with the load trailing;

- While negotiating turns, speed will be reduced to a safe level, and turning will be in a smooth, sweeping motion to avoid abrupt turns and potential upset; and

- Authorized operators will only handle stable or safely arranged loads and loads within the rated capacity of the heavy equipment and will not affect the stability of the heavy equipment.

When a piece of heavy equipment is left unattended, hydraulics will be fully lowered, controls will be neutralized, power will be shut off, and brakes set. Wheels will be blocked or chocked if the heavy equipment is parked on an incline. When internal combustion engine-powered heavy equipment is utilized indoors, near confined spaces, or near excavations, carbon monoxide levels shall be monitored to prevent personnel exposure.

3.2.4 Landfill Cap Construction-Related Activities

Construction-related site activities involve a potential for exposure to many physical and health hazards. Hazards may be associated with the materials and equipment used in construction or the activities themselves.

Physical Hazards: The physical hazards involved with construction relate to work done with heavy equipment, hand tools, and the construction environment itself. There exists a potential for incidents involving personnel struck by or struck against equipment or materials, resulting in fractures, cuts, punctures, or abrasions. Walking and working surfaces during construction activities may involve slip, trip, and fall hazards. Working at elevations may create a potential fall hazard.

Working Surfaces: Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, and slips and falls. All personnel should frequently inspect working surfaces and keep working surface clear of debris.

High Work Operations: Construction workers are exposed to falls when not utilizing fall protection equipment while conducting work at elevations. High work surfaces must be properly protected with railings and toeboards, or personnel must wear fall protection devices.

Materials Handling: The most common type of accident that occurs in material handling operations is the "caught between" situation when a load is being handled and a finger or toe gets caught between two objects. Extreme care must be taken when loading and unloading material. Proper lifting technique must be employed, and mechanical means must be used to lift objects whenever possible.

Health Hazards: Due to the type of work involved in many construction activities, the primary health hazards involve repetitive motion disorders, lifting, and other ergonomic stressors. Noise may also present a hazard. Operation of heavy equipment and power actuated and pneumatic hand tools frequently results in high noise levels. Another health hazard involves the emission of vapors or off-gases during manipulation of certain construction materials.

Control: Prior to initiating any construction activity, the operation will be explained to all employees. Hazards will be identified and protective measures will be explained. Equipment will be inspected and in proper working condition. Employees should receive training to address the equipment, its operations, and care. Personnel should be scheduled in a manner to reduce the likelihood of performing repetitive tasks for prolonged

periods. Mechanical assistance should be provided for large lifting tasks. Hearing protection is required for use when exposed to noise levels exceeding 85 dBA, or a level which commonly results in difficult conversation. Safety precautions for excavation and materials handling activities are discussed in previous sections.

3.2.4.1 Cap Surveying Activities

Surveying activities may involve a potential for exposure to physical and health hazards. Hazards may be associated with the site and the environmental conditions.

Physical Hazards: The physical hazards involved with surveying activities are primarily associated with the site environment. There exists a potential for incidents involving personnel struck by or struck against objects resulting in fractures, cuts, punctures, or abrasions. Walking and working surfaces during activities may involve slip, trip, and fall hazards.

Working Surfaces: Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, and slips and falls. All personnel should frequently inspect working surfaces and keep working surface clear of debris.

Materials Handling: The most common type of accident that occurs in material handling operations is the "caught between" situation when a load is being handled and a finger or toe gets caught between two objects. Extreme care must be taken when loading and unloading material. Proper lifting technique must be employed.

Control: Prior to initiating activity, the site conditions will be discussed with all employees. Hazards will be identified and protective measures will be explained. Equipment will be inspected and in proper working condition. Mechanical assistance should be provided for large lifting tasks. Avoidance of biological hazards as discussed in Section 4.0 will be implemented.

3.2.5 Cap Maintenance Activities

Site cap maintenance activities may include the following:

- Cap Inspection;
- Inspect and Maintain Fence;
- Cap Mowing/Seeding;
- Weed/Foliage Control; and
- Cap Repair.

These activities may involve a potential for exposure to numerous physical and health hazards. The hazards are primarily associated with the equipment used and the debris being removed.

Physical Hazards - The physical hazards involved with cap maintenance activities relate to work done with heavy equipment, hand tools, and the environment itself. There exists a potential for incidents involving personnel struck by or struck against powered equipment, timber, or materials, resulting in fractures, cuts, punctures, or abrasions. Walking and working surfaces during construction activities may involve slip, trip, and fall hazards. Working at elevations may create a fall hazard. Confined Spaces may present a hazard.

Environmental Hazards - Overgrown areas present hazards of uneven walking surfaces, soft terrain, and biological hazards such as insects and snakes.

Working Surfaces - Uneven terrain and slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, and slips and falls. All personnel should frequently inspect the area in which they are working, and keep the area as clear as possible.

Powered Equipment Operations - Site workers are exposed to serious hazards during clearing when using powered equipment. Workers may be struck by blades or by material thrown by powered equipment.

Materials Handling - The most common type of accident that occurs in material handling operations is the "caught between" situation when a load is being handled and a finger or toe gets caught between two objects. Extreme care must be taken when loading and unloading material. Proper lifting technique must be employed, and mechanical means must be used to lift objects whenever possible.

Health Hazards - Due to the type of work involved in cap maintenance activities, the primary health hazards involve repetitive motion disorders, lifting, and other ergonomic stressors. Noise may also present a hazard. Operation of heavy equipment, power equipment, power actuated and pneumatic hand tools frequently results in high noise levels.

Control - Prior to initiating cap maintenance activities, the operation will be explained to all employees. Hazards will be identified and protective measures will be explained. Equipment will be inspected and in proper working condition. Employees should receive training to address the equipment, its operations, and care. Personnel should be scheduled in a manner to reduce the likelihood of performing repetitive tasks for prolonged periods. Mechanical assistance should be provided for large lifting tasks. Hearing protection is required for use when exposed to noise levels exceeding 85 dBA, or a level which commonly results in difficult conversation.

3.2.6 Confined Space Entry

This section contains general requirements and procedures for working with confined spaces. In addition to the general information provided herein, BBL personnel must comply with the requirements of BBL Policy and Procedure Memo #1.02.08 Confined Space Entry (Attachment C). A confined space is defined as a space large enough and so configured that an employee can bodily enter and perform assigned work, has limited means for entry or exit, and is not designed for continuous employee occupancy. Some confined space work may pose additional hazards such as air contamination, flammable or explosive atmosphere, and oxygen deficiency. Confined space entry may pose the possibility of engulfment. Personnel must be properly trained in order to supervise and participate in confined space entry procedures or serve as standby attendants.

All confined spaces are initially considered permit-required and procedures for entry must be consistent with the requirements of BBL Policy and Procedure Memo #1.02.08 Confined Space Entry.

3.2.6.1 Confined Space Identification and Designation

Identification: The BBL SS/HSS is responsible to identify all confined spaces into which BBL employees or subcontractors will enter. Entry is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space. The client is responsible to identify and provide information as to contents, expected atmosphere, and rescue procedures for all confined spaces on his/her property. If a space is

not considered permit required by the client but meets the criteria of this procedure, it shall be considered permit required for BBL-managed entry. If a space does not meet the criteria in this procedure but is considered permit-required by the client, it will be considered a permit-required confined space by BBL.

The permit-required confined spaces for this project may include, but are not limited to: Catch basins, collection tanks, troughs, sumps, and drains.

3.2.7 Monitoring Well Installation

This task includes the installation of groundwater monitoring wells at specified locations for operations and maintenance activities. Prior to monitoring well installation, soil borings will be drilled using the hollow-stem auger drilling technique. After the wells are completed, the wells will be developed using the standard operating procedures.

3.2.7.1 Drilling Hazards

The primary physical hazards for this activity are associated with the use of drilling equipment. Rig accidents can occur as a result of improperly placing the rig on uneven or unstable terrain, or failing to adequately secure the rig prior to the start of operations. Underground and overhead utility lines can create hazardous conditions if contacted by drilling equipment. Tools and equipment, such as elevators, cat lines, and wire rope, have the potential for striking, pinning, or cutting personnel.

- *Wire Rope* - Worn or frayed wire rope presents a laceration hazard if loose wires protrude from the main bundle.

- *Cat Lines* - Cat lines are used on drilling rigs to hoist material. Accidents that occur during cat line operations may injure the employee doing the rigging, as well as injure the operator. Minimal hoisting control causes sudden and erratic load movements, which may result in hand and foot injuries.

- *Working Surfaces* - Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, and slips and falls.

- *Materials Handling* - The most common type of accident that occurs in material handling operations is the "caught between" situation when a load is being handled and a finger or toe gets caught between two objects. Rolling stock can shift and/or fall from a pipe rack or truck bed.

3.2.7.2 Drilling Safety Procedures

Drill Crews - All drillers must possess required state or local licenses to perform such work. All members of the drill crew shall receive site-specific training prior to beginning work.

The driller is responsible for the safe operation of the drill rig, as well as the crew's adherence to the requirements of this HASP. The driller must ensure that all safety equipment is in proper condition and is properly used. The members of the crew must follow all instructions of the driller, wear all PPE, and be aware of all hazards and control procedures. The drill crews must participate in the Daily Safety Meetings and be aware of all emergency procedures.

Rig Inspection - Each day, prior to the start of work, the drill rig and associated equipment must be inspected by the driller and/or drill crew. The following items must be inspected:

- vehicle condition;
- proper storage of equipment;
- condition of all wire rope and hydraulic lines;
- fire extinguisher; and
- first aid kit.

Drill Rig Set Up - The drill rig must be properly blocked and leveled prior to raising the derrick. The wheels which remain on the ground must be chocked. The leveling jacks shall not be raised until the derrick is lowered. The rig shall be moved only after the derrick has been lowered.

Site Drilling Rules - Before drilling, the existence and location of underground pipe, electrical equipment, and gas lines will be determined. This will be done, if possible, by contacting the appropriate client representative to mark the location of the lines. If the client's knowledge of the area is incomplete, an appropriate device, such as a magnetometer, will be used to locate the line. The Underground/Overhead Utility Checklist shall be used to document that nearby utilities have been marked on the ground, and that the drill site has been cleared. The checklist shall be in the possession of the SS prior to commencement of the intrusive investigation at that point of the site (Attachment D).

Combustible gas readings of the general work area will be made regularly (see Section 8).

Operations must be suspended and corrective action taken if the airborne flammable concentration reaches 10 percent of LEL in the immediate area (a one-foot radius) of the point of drilling, or near any other ignition sources.

Under no circumstances will personnel be permitted to ride the traveling block or elevators, nor will the cat line be used as a personnel carrier.

Overhead Electrical Clearances - If drilling is conducted in the vicinity of overhead power lines, the power to the lines must be shut off or the equipment must be positioned and blocked such that no part, including cables, can come within the minimum clearances as follows:

Nominal System Voltage	Minimum Required Clearance
0-50kV	10 feet
51-100kV	12 feet
101-200kV	15 feet
201-300kV	20 feet
301-500kV	25 feet
501-750kV	35 feet
751-1,000kV	45 feet

When the drill rig is in transit, with the boom lowered and no load, the equipment clearance must be at least 4 feet for voltages less than 50kV, 10 feet for voltages of 50kV to 345kV, and 16 feet for voltages above 345kV.

Rig Set Up - All well sites will be inspected by the driller prior to the location of the rig to verify a stable surface exists. This is especially important in areas where soft, unstable terrain is common.

All rigs will be properly blocked and leveled prior to raising the derrick. Blocking provides a more stable drilling structure by evenly distributing the weight of the rig. Proper blocking ensures that differential settling of the rig does not occur.

When the ground surface is soft or otherwise unstable, wooden blocks, at least 24 inches by 24 inches and 4 inches to 8 inches thick, shall be placed between the jack swivels and the ground. The emergency brake shall be engaged, and the wheels that are on the ground shall be chocked.

Hoisting Operations - Drillers should never engage the rotary clutch without watching the rotary table, and ensuring it is clear of personnel and equipment.

Unless the drawworks is equipped with an automatic feed control, the brake should not be left unattended without first being tied down.

Auger strings or casing should be picked up slowly.

During instances of unusual loading of the derrick or mast, such as when making an unusually hard pull, only the driller should be on the rig floor; no one else should be on the rig or derrick.

The brakes on the drawworks of the drill rig should be tested by the driller each day. The brakes should be thoroughly inspected by a competent individual each week.

A hoisting line with a load imposed should not be permitted to be in direct contact with any derrick member or stationary equipment, unless it has been specifically designed for line contact.

Workers should never stand near the borehole whenever any wire line device is being run.

Hoisting control stations should be kept clean and controls labeled as to their functions.

Cat Line Operations - Only experienced workers will be allowed to operate the cathead controls. The kill switch must be clearly labeled and operational prior to operation of the cat line. The cathead area must be kept free of obstructions and entanglements.

The operator should not use more wraps than necessary to pick up the load. More than one layer of wrapping is not permitted.

Personnel should not stand near, step over, or go under a cable or cat line which is under tension.

Employees rigging loads on cat lines shall:

- keep out from under the load;

- keep fingers and feet where they will not be crushed;
- be sure to signal clearly when the load is being picked up;
- use standard visual signals only and not depend on shouting to co-workers; and
- make sure the load is properly rigged, since a sudden jerk in the cat line will shift or drop the load.

Wire Rope - When two wires are broken or rust or corrosion is found adjacent to a socket or end fitting, the wire rope shall be removed from service or resocketed. Special attention shall be given to the inspection of end fittings on boom support, pendants, and guy ropes.

Wire rope removed from service due to defects shall be cut up or plainly marked as being unfit for further use as rigging.

Wire rope clips attached with U-bolts shall have the U-bolts on the dead or short end of the rope; the clip nuts shall be re-tightened immediately after initial load carrying use and at frequent intervals thereafter.

When a wedge socket fastening is used, the dead or short end of the wire rope shall have a clip attached to it or looped back and secured to itself by a clip; the clip shall not be attached directly to the live end.

Protruding ends of strands in splices on slings and bridles shall be covered or blunted.

Except for eye splices in the ends of wires and for endless wire rope slings, wire rope used in hoisting, lowering, or pulling loads, shall consist of one continuous piece without knot or splice.

An eye splice made in any wire rope shall have not less that five full tucks.

Wire rope shall not be secured by knots. Wire rope clips shall not be used to splice rope.

Eyes in wire rope bridles, slings, or bull wires shall not be formed by wire clips or knots.

Auger Handling - Auger sections shall be transported by cart or carried by two persons. Individuals should not carry auger sections without assistance.

Workers should not be permitted on top of the load during loading, unloading, or transferring of rolling stock.

When equipment is being hoisted, personnel should not stand where the bottom end of the equipment could whip and strike them.

Augers stored in racks, catwalks, or on flatbed trucks should be secured to prevent rolling.

3.2.8 Groundwater Sampling/Elevation Activities

The groundwater sampling program will involve uncapping, purging (pumping water out of the well), and sampling existing monitoring wells. A mechanical pump may be utilized to purge the wells and can be hand-, gas-, or electric-operated. Water samples taken from the wells are then placed in containers and shipped to an analytical laboratory for analysis.

During the course of this project, several different sampling methodologies may be utilized based on equipment accessibility and the types of materials to be sampled. These sampling methods may include hand or mechanical bailing. The primary hazards associated with these specific sampling methods are not potentially serious; however, other operations in the area, or the conditions under which samples must be collected, may present chemical and physical hazards. The hazards of these types of sampling methods are generally limited to strains/sprains resulting from hand bailing and potential eye hazards resulting from water sampling activities.

In addition to the safety hazards specific to sampling operations, hazards associated with sample preservatives will be a concern. The work area presents slip, trip and fall hazards from scattered debris and irregular walking surfaces. Freezing-weather hazards include frozen, slick and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces and unstable soil.

Exposure to impacted water is possible. Organic vapors will be monitored according to Section 8, Air Monitoring. In accordance with Section 5, decisions on personal protective equipment (PPE) for the chemical hazards will be based on measurements made before and during work activities. Control procedures for environmental and general hazards are discussed in Section 4.0.

3.2.9 Equipment Decontamination

All equipment which comes in contact with sediment, leachate, and groundwater will be decontaminated before leaving the site. Personnel involved in decontamination activities may be exposed to skin contact with contaminated materials and chemicals brought to the site as part of the project work. Personnel involved in decontamination activities must wear PPE specified in Section 5.

3.3 Chemical Hazards

3.4 Chemical Hazards

The chemical hazards associated with site operations are related to inhalation, ingestion, and skin exposure to soil and sediment containing site constituents of concern (COCs). Site COCs include chromium, lead, copper, and mercury.

Airborne concentrations of site COCs may be measurable during certain tasks, and will require air monitoring of potentially toxic atmospheres during such operations. Air monitoring requirements for site tasks are outlined in Section 8.1.

The potential for inhalation of COCs during intrusive excavation, drilling, and sampling is moderate. The potential for dermal contact during intrusive excavation, drilling, and sampling activities is moderate.

The Material Safety Data Sheets (MSDSs) for site COCs are included in Attachment E.

TABLE 3-1
CHEMICAL HAZARD INFORMATION

Substance [CAS]	IP[a] (eV)	Odor Threshold (ppm)	Route[b]	Symptoms of Exposure	Treatment	TWA[c]	STEL[d]	Source[e]	IDLH (NIOSH)[f]
Chromic acid and chromates (as CrO_3) (Chrome VI) [7738-94-5]	NA	NA	Inh Ing Con	Respiratory system irritation, nasal septum perforation; liver and kidney damage; leukocytosis, leukopenia, monocytosis, eosinophilia; eye injury and conjunctivitis; skin ulceration and dermal sensitization. Carcinogenic.	Eye: Irrigate immediately Skin: Soap flush immediately Breath: Respiratory support Swallow: Immediate medical attention	0.05 mg/m³* 0.001 mg/m³* *as Cr	C0.1 mg/m³* *as CrO_3	PEL TLV REL	Ca [30 mg/m³]
Chromium metal (as Cr) [7440-47-3]	NA	NA	Inh Ing	Histologic fibrosis of lungs.	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	1 mg/m³ 0.5 mg/m³ 0.5 mg/m³		PEL TLV REL	NE
Copper dusts and mists (metal) (copper sulfate) [7440-50-8]	NA	NA	Inh Ing Con	Irritated pharynx and nasal mucous membrane; nasal perforation; eye irritation; metallic taste; dermatitis; in animals: lung, kidney, and liver damage; anemia.	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	1 mg/m³ 1 mg/m³ 1 mg/m³		PEL TLV REL	NE
Mercury vapor [7439-97-6]	NA	NA	Inh Abs Con	Coughing, chest pain, dyspnea, bronchial pneumonitis; tremors, insomnia; irritability, indecision; headache, fatigue, weakness stomatitis, salivation; gastrointestinal disturbance, anorexia, low weight; proteinuria, irritated eyes, and skin.	Eye: Irrigate immediately Skin: Soap wash promptly Breath: Respiratory support Swallow: Immediately medical attention	0.05 mg/m³ (skin) 0.05 mg/m³ (skin) 0.05 mg/m³ (skin)		PEL TLV REL	28 mg/m³
Lead inorganic dusts & fumes (as Pb) [7439-92-1]	NA	NA	Inh Ing Con	Weakness, lassitude, insomnia; facial pallor; eye pallor, anorexia, low body weight, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremors; wrist and ankle paralysis; brain damage; kidney damage; irritated eyes; hypotension	Eye: Irrigate immediately Skin: Soap flush promptly Breath: Respiratory support Swallow: Immediate medical attention	0.05 mg/m³ 0.15 mg/m³ <0.1 mg/m³ See 29 CFR 1910.1025 Blood lead <0.060 mg/100 g whole blood		PEL TLV REL	700 mg/m³

Refer to footnotes at end of table.

TABLE 3-1 (CONT'D)
CHEMICAL HAZARD INFORMATION

[a]IP = Ionization potential (electron volts).
[b]Route = Inh, Inhalation; Abs, Skin absorption; Ing, Ingestion; Con, Skin and/or eye contact.
[c]TWA = Time-weighted average. The TWA concentration for a normal work day (usually 8 or 10 hours) and a 40-hour work week, to which nearly all workers may be repeatedly exposed, day after day without adverse effect.
[d]STEL = Short-term exposure limit. A 15-minute TWA exposure that should not be exceeded at any time during a workday, even if the TWA is not exceeded.
[e]PEL = Occupational Safety and Health Administration (OSHA) permissible exposure limit (29 CFR 1910.1000, Table Z).
TLV = American Conference of Governmental Industrial Hygiene (ACGIH) threshold limit value—TWA.
REL = National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit.
[f]IDLH (NIOSH)—Immediately dangerous to life or health (NIOSH). Represents the maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without a respirator and without experiencing any escape-impairing or irreversible health effects.
NE = No evidence could be found for the existence of an IDLH (NIOSH Pocket Guide to Chemical Hazards, Pub. No. 90-117, 1990).
C = Ceiling limit value which should not be exceeded at any time.
Ca = Carcinogen.
NA = Not applicable.
? = Unknown.
LEL = Lower explosive limits.
LC_{50} = Lethal concentration for 50 percent of population tested.
LD_{50} = Lethal dose for 50 percent of population tested.
NIC = Notice of intended change (ACGIH).

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Refer to footnotes at end of table.

Section 4

4. General Safety Practices

4.1 General Practices

General safety procedures for site activities include, but are not limited to the following:

- At least one copy of this plan must be at the project site, in a location readily available to all personnel, and reviewed by all project personnel prior to starting work.
- Food, beverages, or tobacco products must not be present or consumed in the exclusion and contamination reduction zones. Cosmetics must not be applied within these zones.
- Contaminated waste, debris, and used protective clothing must be properly contained and labeled.
- Removing contamination from protective clothing or equipment with compressed air, shaking, or any other means that disperses constituents into the air is prohibited.
- Visitors to the site must abide by the following:
  - All visitors must be instructed to remain within the support zone during the extent of their stay.
  - Visitors must be cautioned to avoid skin contact with surfaces which are contaminated or suspected to be contaminated.

4.1.1 Buddy System

All on-site personnel must use the buddy system. Visual contact must be maintained between crew members at all times, and crew members must observe each other for signs of chemical exposure, heat or cold stress. Indications of adverse effects include, but are not limited to:

- changes in complexion and skin coloration;
- changes in coordination;
- changes in demeanor;
- excessive salivation and pupillary response; and
- changes in speech pattern.
- Team members must also be aware of potential exposure to possible safety hazards, unsafe acts, or non-compliance with safety procedures.
- Employees must inform their fellow team members of non-visible effects of exposure to toxic materials. The symptoms of such exposure may include:
  - headaches;
  - dizziness;

- nausea;
- blurred vision;
- cramps; and/or
- irritation of eyes, skin, or respiratory tract.

- If protective equipment or noise levels impair communications, prearranged hand signals must be used for communication. Personnel must stay within line of sight of another team member.

4.1.2 Emergency Equipment

Adequate emergency equipment will be maintained on site for the activities conducted on site and as required by applicable sections of 29 CFR 1910 and 29 CFR 1926. Personnel will be provided with access to emergency equipment including but limited to the following:

- Emergency eyewash and shower, meeting ANSI Z358.1-1990 requirements.
- Fire extinguishers of adequate size, class, number, and location as required by applicable sections of 29 CFR 1910 and 29 CFR 1926.
- Industrial First Aid Kit of adequate size for number of personnel on site.

4.2 Heat Stress

Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, etc., as well as the physical and conditioning characteristics of the individual. Since heat stress is one of the most common illnesses associated with heavy outdoor work conducted with direct solar load and, in particular, because wearing PPE can increase the risk of developing heat stress, workers must be capable of recognizing the signs and symptoms of heat-related illnesses. Personnel must be aware of the types and causes of heat-related illnesses and be able to recognize the signs and symptoms of these illnesses in both themselves and their co-workers.

Heat rashes are the one of the most common problems in hot work environments. Commonly known as prickly heat, a heat rash is manifested as red papules and usually appears in areas where the clothing is restrictive. As sweating increases, these papules give rise to a prickling sensation. Prickly heat occurs in skin that is persistently wetted by unevaporated sweat, and heat rash papules may become infected if they are not treated. In most cases, heat rashes will disappear when the affected individual returns to a cool environment.

Heat cramps are usually caused by performing hard physical labor in a hot environment. These cramps have been attributed to an electrolyte imbalance caused by sweating. It is important to understand that cramps can be caused both by too much and too little salt.

Cramps appear to be caused by the lack of water replenishment. Because sweat is a hypotonic solution (plus or minus 0.3% NaCl), excess salt can build up in the body if the water lost through sweating is not replaced. Thirst cannot be relied on as a guide to the need for water; instead, water must be taken every 15 to 20 minutes in hot environments.

Under extreme conditions, such as working for 6 to 8 hours in heavy protective gear, a loss of sodium may occur. Drinking commercially available carbohydrate-electrolyte replacement liquids is effective in minimizing physiological disturbances during recovery.

Heat exhaustion occurs from increased stress on various body organs due to inadequate blood circulation, cardiovascular insufficiency, or dehydration. Signs and symptoms include pale, cool, moist skin; heavy sweating; dizziness; nausea; headache, vertigo, weakness, thirst, and giddiness. Fortunately, this condition responds readily to prompt treatment.

Heat exhaustion should not be dismissed lightly, however, for several reasons. One is that the fainting associated with heat exhaustion can be dangerous because the victim may be operating machinery or controlling an operation that should not be left unattended; moreover, the victim may be injured when he or she faints. Also, the signs and symptoms seen in heat exhaustion are similar to those of heat stroke, which is a medical emergency.

Workers suffering from heat exhaustion should be removed from the hot environment, be given fluid replacement, and be encouraged to get adequate rest.

Heat stroke is the most serious form of heat stress. Heat stroke occurs when the body's system of temperature regulation fails and the body's temperature rises to critical levels. This condition is caused by a combination of highly variable factors, and its occurrence is difficult to predict.

Heat stroke is a medical emergency. The primary signs and symptoms of heat stroke are confusion; irrational behavior; loss of consciousness; convulsions; a lack of sweating (usually); hot, dry skin; and an abnormally high body temperature, e.g., a rectal temperature of 41°C (105.8°F). If body temperature is too high, it causes death. The elevated metabolic temperatures caused by a combination of work load and environmental heat load, both of which contribute to heat stroke, are also highly variable and difficult to predict.

If a worker shows signs of possible heat stroke, professional medical treatment should be obtained immediately. The worker should be placed in a shady area and the outer clothing should be removed. The worker's skin should be wetted and air movement around the worker should be increased to improve evaporative cooling until professional methods of cooling are initiated and the seriousness of the condition can be assessed. Fluids should be replaced as soon as possible. The medical outcome of an episode of heat stroke depends on the victim's physical fitness and the timing and effectiveness of first aid treatment.

Regardless of the worker's protestations, any employee suspected of being ill from heat stroke should not be sent home or left unattended unless a physician has specifically approved such an order.

Proper training and preventive measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important because once someone suffers from heat stroke or exhaustion, that person may be predisposed to additional heat injuries.

Heat Stress Safety Precautions

Heat stress monitoring and work rest cycle implementation should commence when the ambient adjusted temperature exceeds 72°F. A minimum work rest regimen and procedures for calculating ambient adjusted temperature are described in the Table 4-1.

TABLE 4-1
WORK/REST SCHEDULE

Adjusted Temperature[b]	*Work-Rest Regimen Normal Work Ensemble*[c]	*Work-Rest Regimen Impermeable Ensemble*
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°-90°F (30.8°-32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5°-87.5°F (28.1°-30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5°-77.5°F (30.8°-32.2°C)	After each 150 minutes of work	After each 120 minutes of work

[a] For work levels of 250 kilocalories/hour (Light-Moderate Type of Work)
[b] Calculate the adjusted air temperature (ta adj) by using this equation: ta adj °F = ta °F + (13 x % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)
[c] A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.
[d] The information presented above was generated using the information provided in the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV) Handbook.

In order to determine if the work rest cycles are adequate for the personnel and specific site conditions additional monitoring of individuals' heart rates will be conducted during the rest cycle. To check the heart rate, count the radial pulse for 30 seconds at the beginning of the rest period. If the heart rate exceeds 110 beats per minute, shorten the next work period by one-third and maintain the same rest period.

Additionally, one or more of the following control measures can be used to help control heat stress and are mandatory if any site worker has a heart rate (measure immediately prior to rest period) exceeding 115 beats per minute:

- Site workers will be encouraged to drink plenty of water and electrolyte replacement fluids throughout the day.
- On-site drinking water will be kept cool (50 to 60°F).
- A work regimen that will provide adequate rest periods for cooling down will be established, as required.
- All personnel will be advised of the dangers and symptoms of heat stroke, heat exhaustion, and heat cramps.
- Cooling devices, such as vortex tubes or cooling vests, should be used when personnel must wear impermeable clothing in conditions of extreme heat.
- Employees should be instructed to monitor themselves and co-workers for signs of heat stress and to take additional breaks as necessary.
- A shaded rest area must be provided. All breaks should take place in the shaded rest area.
- Employees must not be assigned to other tasks during breaks.

- Employees must remove impermeable garments during rest periods. This includes white Tyvek-type garments.

- All employees must be informed of the importance of adequate rest, acclimation, and proper diet in the prevention of heat stress disorders.

4.3 Cold Stress Hazards

Cold stress normally occurs in temperatures at or below freezing, or under certain circumstances, in temperatures of 40°F. Extreme cold for a short time may cause severe injury to exposed body surfaces or result in profound generalized cooling, causing death. Areas of the body which have high surface area-to-volume ratio, such as fingers, toes, and ears, are the most susceptible. Two factors influence the development of a cold weather injury: ambient temperature and the velocity of the wind. For instance, 10°F with a wind of 15 miles per hour (mph) is equivalent in chilling effect to still air at -18°F. **An equivalent chill temperature chart relating the actual dry bulb temperature and wind velocity is presented in Table 4-2.**

TABLE 4-2
CHILL TEMPERATURE CHART

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	LITTLE DANGER Maximum danger of false sense of security.				INCREASING DANGER Danger from freezing of exposed flesh within one minute.			GREAT DANGER Flesh may freeze within 30 seconds.				
	Trench foot and immersion foot may occur at any point on this chart.											

[This chart was developed by the U.S. Army Research Institute of Environmental Medicine, Natick, MA (Source: ACGIH Threshold Limit Values for Chemical Substances and Physical Agents).]

Local injury resulting from cold is included in the generic term frostbite. There are several degrees of tissue damage associated with frostbite. Frostbite of the extremities can be categorized into:

- *Frost Nip or Incipient Frostbite* - characterized by suddenly blanching or whitening of skin.

- *Superficial Frostbite* - skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.

- *Deep Frostbite* - tissues are cold, pale, and solid; extremely serious injury.

Systemic hypothermia is caused by exposure to freezing or rapidly dropping temperature. It can be fatal. Its symptoms are usually exhibited in five stages: 1) shivering; 2) apathy, listlessness, sleepiness, and (sometimes) rapid cooling of the body to less than 95°F; 3) unconsciousness, glassy stare, slow pulse, and slow respiratory rate; 4) freezing of the extremities; and 5) death. Trauma sustained in freezing or sub-zero conditions requires special attention because an injured worker is predisposed to secondary cold injury. Special provisions must be made to prevent hypothermia and secondary freezing of damaged tissues in addition to providing for first aid treatment. To avoid cold stress, site personnel must wear protective clothing appropriate for the level of cold and physical activity. In addition to protective clothing, preventive safe work practices, additional training, and warming regimens may be utilized to prevent cold stress.

Safety Precautions for Cold Stress Prevention

- For air temperature of 0°F or less, the hands should be protected by mittens. For exposed skin, continuous exposure should not be permitted when air speed and temperature results in a wind chill temperature of -25°F.

- At air temperatures of 36°F or less, field personnel who become immersed in water or whose clothing becomes wet must be immediately provided with a change of clothing and be treated for hypothermia.

- If work is done at normal temperature or in a hot environment before entering the cold, the field personnel must ensure that their clothing is not wet as a consequence of sweating. If wet, field personnel must change into dry clothes prior to entering the cold area.

- If the available clothing does not give adequate protection to prevent hypothermia or frostbite, work must be modified or suspended until adequate clothing is made available or until weather conditions improve.

- Field personnel handling evaporative liquid (e.g., gasoline, alcohol, or cleaning fluids) at air temperatures below 40°F must take special precaution to avoid soaking of clothing or gloves with the liquids because of the added danger of cold injury due to evaporative cooling.

Safe Work Practices

- Direct contact between bare skin and cold surfaces ($\leq$ 20°F) should be avoided. Metal tool handles and/or equipment controls should be covered by thermal insulating material.

- For work performed in a wind chill temperature at or below 10°F, workers should be under constant protective observation (buddy system). The work rate should be established to prevent heavy sweating that will result in wet clothing. For heavy work, rest periods must be taken in heated shelters and workers should be provided with an opportunity to change into dry clothing if needed.

- Field personnel should be provided the opportunity to become accustomed to cold-weather working conditions and required protective clothing.

- Work should be arranged in such a way that sitting or standing still for long periods is minimized.

During the warming regimen (rest period), field personnel should be encouraged to remove outer clothing to permit sweat evaporation or to change into dry work clothing. Dehydration, or loss of body fluids, occurs insidiously in the cold environment and may increase susceptibility to cold injury due to a significant change in blood flow to the extremities. Fluid replacement with warm, sweet drinks and soups is recommended. The intake of coffee should be limited because of diuretic and circulatory effects.

4.4 Biological Hazards

Biological hazards may include poison ivy, snakes, thorny bushes and trees, ticks, mosquitoes, and other pests.

4.4.1 Tick-Borne Diseases

Lyme disease, erlichiosis, and Rocky Mountain Spotted Fever (RMSF) are diseases transmitted by ticks and occur throughout the United States during spring, summer, and fall.

Lyme Disease - The disease commonly occurs in summer and is transmitted by the bite of infected ticks. "Hot spots" in the United States include New York, New Jersey, Pennsylvania, Massachusetts, Connecticut, Rhode Island, Minnesota and Wisconsin. Few cases have been identified in other states.

Erlichiosis - The disease also commonly occurs in summer and is transmitted by the bite of infected ticks. "Hot spots" in the United States include New York, Massachusetts, Connecticut, Rhode Island, Minnesota and Wisconsin. Few cases have been identified in other states.

These diseases are transmitted primarily by the deer tick, which is smaller and redder than the common wood tick. The disease may be transmitted by immature ticks, which are small and hard to see. The tick may be as small as a period on this page.

Symptoms of Lyme disease include a rash or a peculiar red spot, like a bull's eye, which expands outward in a circular manner. The victim may have headache, weakness, fever, a stiff neck, swelling and pain in the joints, and eventually, arthritis. Symptoms of erlichiosis include muscle and joint aches, flu-like symptoms, but there is typically no skin rash.

Rocky Mountain Spotted Fever - This disease is transmitted via the bite of an infected tick. The tick must be attached 4 to 6 hours before the disease-causing organism (*Rickettsia rickettsii*) becomes reactivated and can infect humans. The primary symptom of RMSF is the sudden appearance of a moderate-to-high fever. The fever may persist for two to three weeks. The victim may also have a headache, deep muscle pain, and chills. A rash appears on the hands and feet on about the third day and eventually spreads to all parts of the body. For this reason, RMSF may be confused with measles or meningitis. The disease may cause death, if untreated, but if identified and treated promptly, death is uncommon.

Control - Tick repellant containing diethyltoluamide (DEET) should be used when working in tick-infested areas, and pants legs should be tucked into boots. In addition, workers should search the entire body every three or four hours for attached ticks. Ticks should be removed promptly and carefully without crushing, since

crushing can squeeze the disease-causing organism into the skin. A gentle and steady pulling action should be used to avoid leaving the head or mouth parts in the skin. Hands should be protected with surgical gloves when removing ticks.

4.4.2 Poisonous Plants

Poison ivy may be present in the work area. Personnel should be alerted to its presence, and instructed on methods to prevent exposure.

Control - The main control is to avoid contact with the plant, cover arms and hands, and frequently wash potentially exposed skin. Particular attention must be given to avoiding skin contact with objects or protective clothing that have touched the plants. Treat every surface that may have touched the plant as contaminated, and practice contamination avoidance. If skin contact is made, the area should be washed immediately with soap and water, and observed for signs of reddening.

4.4.3 Snakes

The possibility of encountering snakes exists, specifically for personnel working in wooded/vegetated areas. Snake venoms are complex and include proteins, some of which have enzymatic activity. The effects produced by venoms include neurotoxic effects with sensory, motor, cardiac, and respiratory difficulties; cytotoxic effects on red blood cells, blood vessels, heart muscle, kidneys, and lungs; defects in coagulation; and effects from local release of substances by enzymatic actions. Other noticeable effects of venomous snake bites include swelling, edema, and pain around the bite, and the development of ecchymosis (the escape of blood into tissues from ruptured blood vessels).

Control - To minimize the threat of snake bites and insect hazards, all personnel walking through vegetated areas must aware of the potential for encountering snakes, and the need to avoid actions potentiating encounters, such as turning over logs, etc. If a snake bite occurs, an attempt should be made to kill the snake for identification. The victim must be transported to the nearest hospital within 30 minutes; first aid consists of applying a constriction band, and washing the area around the wound to remove any unabsorbed venom.

4.5 Noise

Exposure to noise over the OSHA action level can cause temporary impairment of hearing; prolonged and repeated exposure can cause permanent damage to hearing. The risk and severity of hearing loss increases with the intensity and duration of exposure to noise. In addition to damaging hearing, noise can impair voice communication, thereby increasing the risk of accidents on site.

Control - All personnel must wear hearing protection - with a Noise Reduction Rating (NRR) of at least 20 - when noise levels exceed 85 dBA. When it is difficult to hear a co-worker at normal conversation distance, the noise level is approaching or exceeding 85 dBA, and hearing protection is necessary. All site personnel who may be exposed to noise must also receive baseline and annual audiograms and training as to the causes and prevention of hearing loss. Noise monitoring is discussed in Section 8.

Whenever possible, equipment that does not generate excessive noise levels will be selected for this project. If the use of noisy equipment is unavoidable, barriers or increased distance will be used to minimize worker exposure to noise, if feasible.

4.6 Sanitation

Site sanitation will be maintained according to OSHA and Department of Health requirements.

4.6.1 Break Area

Breaks must be taken in the SZ, away from the active work area after site personnel go through decontamination procedures. There will be no smoking, eating, drinking, or chewing gum or tobacco in the area other than the SZ.

4.7 Electrical Hazards

Electricity may pose a particular hazard to site workers due to the use of portable electrical equipment. If wiring or other electrical work is needed, it must be performed by a qualified electrician.

General electrical safety requirements include:

- All electrical wiring and equipment must be a type listed by UL, Factory Mutual Engineering Corporation (FM), or other recognized testing or listing agency.
- All installations must comply with the National Electrical Safety Code (NESC), the National Electrical Code (NEC), or United States Coast Guard regulations.
- Portable and semi-portable tools and equipment must be grounded by a multiconductor cord having an identified grounding conductor and a multi-contact polarized plug-in receptacle.
- Tools protected by an approved system of double insulation, or its equivalent, need not be grounded. Double insulated tools must be distinctly marked and listed by UL or FM.
- Live parts of wiring or equipment must be guarded to prevent persons or objects from touching them.
- Electric wire or flexible cord passing through work areas must be covered or elevated to protect it from damage by foot traffic, vehicles, sharp corners, projections, or pinching.
- All circuits must be protected from overload.
- Temporary power lines, switch boxes, receptacle boxes, metal cabinets, and enclosures around equipment must be marked to indicate the maximum operating voltage.
- Plugs and receptacles must be kept out of water unless of an approved submersible construction.
- All extension outlets must be equipped with ground fault circuit interrupters (GFCI).
- Attachment plugs or other connectors must be equipped with a cord grip and be constructed to endure rough treatment.
- Extension cords or cables must be inspected prior to each use and replaced if worn or damaged. Cords and cables must not be fastened with staples, hung from nails, or suspended by bare wire.

- Flexible cords must be used only in continuous lengths without splice, with the exception of molded or vulcanized splices made by a qualified electrician.

4.8 Lifting Hazards

Back strain or injury may be prevented by using proper lifting techniques. The fundamentals of proper lifting include:

- Consider the size, shape, and weight of the object to be lifted. A mechanical lifting device or additional persons must be used to lift an object if it cannot be lifted safely alone.
- The hands and the object should be free of dirt or grease that could prevent a firm grip.
- Gloves must be used, and the object inspected for metal slivers, jagged edges, burrs, or rough or slippery surfaces.
- Fingers must be kept away from points which could crush or pinch them, especially when putting an object down.
- Feet must be placed far enough apart for balance. The footing should be solid and the intended pathway should be clear.
- The load should be kept as low as possible, close to the body with the knees bent.
- To lift the load, grip firmly and lift with the legs, keeping the back as straight as possible.
- A worker should not carry a load that he or she cannot see around or over.
- When putting an object down, the stance and position are identical to that for lifting - the legs are bent at the knees and the back is straight as the object is lowered.

Section 5

5. Personal Protective Equipment

5.1 General

Personal protective equipment is required to safeguard site personnel from various hazards. Varying levels of protection may be required depending on the level of contaminants and the degree of physical hazard. This section presents the various levels of protection and defines the conditions of use for each level.

5.2 Levels of Protection

Protection levels are determined based upon contaminants present in the work area. A summary of the levels is presented in this section.

5.2.1 Level D Protection

The minimum level of protection that will be required of BBL personnel and subcontractors at the site will be Level D, which will be worn when site conditions or air monitoring indicates no inhalation hazard exists. The following equipment will be used:

- Work clothing as prescribed by weather;
- Safety toe work boots, meeting ANSI Z41;
- Safety glasses or goggles, meeting ANSI Z87;
- ANSI Z89 approved hard hat when falling objects and/or hazards are present; and
- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a US EPA NRR of at least 20 dBA must be used).

5.2.2 Modified Level D Protection

Modified Level D will be used when airborne constituents are not present at levels of concern, but site activities present an increased potential for skin contact with contaminated materials. Modified Level D consists of:

- Tyvek® coveralls;
- Safety toe work boots;
- Vinyl or latex booties, or PVC overboots when contact with contaminated media is anticipated;
- Safety glasses or goggles;
- Hard hat;
- Face shield in addition to safety glasses or goggles when projectiles pose a hazard;
- Nitrile gloves; and
- Hearing protection (if necessary).

5.2.3 Level C Protection

Level C protection will be required when the airborne concentration of site constituents reaches ½ the OSHA PEL or ACGIH TLV. The following equipment will be used for Level C protection:

- MSA UltraTwin full-face, air purifying respirator with GMC-H cartridges, or equivalent;
- Tyvek® coverall suit, ankles and cuffs taped to boots and gloves;
- Nitrile gloves over nitrile sample gloves;
- ANSI approved safety toe work boots;
- Chemical resistant Neoprene boots with steel toes or latex/PVC booties over safety toe shoes;
- ANSI approved hard hat; and
- Hearing protection (if necessary).

5.2.4 Selection of PPE

Equipment for personal protection will be selected based on the potential for contact, site conditions, ambient air quality, and the judgment of supervising site personnel and HS professionals. The PPE used will be chosen to be effective against the compound(s) present on the site.

5.3 Site Respiratory Protection Procedures

Respiratory protection is an integral part of employee health and safety at the site due to the potential for airborne constituents.

Site respiratory protection procedures will consist of the following:

- All site personnel who may use respiratory protection will have an assigned respirator.
- All site personnel who may use respiratory protection will have been fit tested and trained in the use of a full-face air purifying respirator within the past 12 months.
- All site personnel who may use respiratory protection must within the past year have been medically certified as being capable of wearing a respirator. Documentation of the medical certification must be provided to the HSS, prior to commencement of site work.
- Only cleaned, maintained, NIOSH/MSHA-approved respirators are to be used on this site.
- If respirators are used, the respirator cartridge is to be properly disposed of at the end of each work shift, or when load-up or breakthrough occurs.
- Contact lenses are not to be worn on-site.

- All site personnel who may use respiratory protection must be clean-shaven. Mustaches and sideburns are permitted, but they must not touch the sealing surface of the respirator.

- Respirators will be inspected, and a negative pressure test performed prior to each use.

- After each use, the respirator will be wiped with a disinfectant, cleansing wipe. When used, the respirator will be thoroughly cleaned at the end of the work shift. The respirator will be stored in a clean plastic bag, away from direct sunlight in a clean, dry location, in a manner that will not distort the face piece.

5.4 Using PPE

Depending upon the level of protection selected, specific donning and doffing procedures may be required. The procedures presented in this section are mandatory when Modified Level D, Level C, or B PPE is used.

All people entering the EZ must put on the required PPE in accordance with the requirements of this plan. When leaving the EZ, PPE will be removed in accordance with the procedures listed, to minimize the spread of contamination.

5.4.1 Donning Procedures

These procedures are mandatory when Modified Level D or higher PPE is used on the project:

- Remove bulky outerwear. Remove street clothes and store in clean location;

- Put on work clothes or coveralls;

- Put on the required chemical protective coveralls or rain gear;

- Put on the required chemical protective boots or boot covers;

- Tape the legs of the coveralls to the boots with duct tape;

- Put on the required chemical protective gloves;

- Tape the wrists of the protective coveralls to the gloves;

- Don the required respirator (Level C or higher) and perform appropriate fit check;

- Put hood or head covering over head and respirator straps (Level C or higher) and tape hood to facepiece; and

- Don remaining PPE, such as safety glasses or goggles and hard hat.

When these procedures are instituted, one person must remain outside the work area to ensure that each person entering has the proper protective equipment.

5.4.2 Doffing Procedures

The following procedures are mandatory when Modified Level D or higher PPE is required for this project. Whenever a person leaves a Modified Level D or higher work site, the following decontamination sequence will be followed:

- Upon entering the CRZ, rinse contaminated materials from the boots or remove contaminated boot covers;
- Clean reusable protective equipment;
- Remove protective garments, equipment, and respirator (Level C or higher). All disposable clothing should be placed in plastic bags, which are labeled with contaminated waste labels;
- Wash hands, face and neck or shower (if necessary);
- Proceed to clean area and dress in clean clothing; and
- Clean and disinfect respirator (Level C or higher) for next use.

All disposable equipment, garments, and PPE must be bagged in plastic bags, labeled for disposal. See Section 7 for detailed information on decontamination stations.

5.5 Selection Matrix

The level of personal protection selected will be based upon real-time air monitoring of the work environment and an assessment by the SS/HSS of the potential for skin contact with impacted materials. The PPE selection matrix is given in Table 5-1. This matrix is based on information available at the time this plan was written. The Airborne Constituent Action Levels in Table 8-1 should be used to verify the need for upgrade and downgrade of PPE.

TABLE 5-1
PPE SELECTION MATRIX

Task	Anticipated Minimum Level of Protection for Task Initiation
Support zone work	Level D
Mobilization / Demobilization	Level D: Support Zone Modified Level D: Exclusion Zone
Site Inspection and observation activities	Level D with boots and gloves as necessary
Excavation and Handling of Soil	Modified Level D
Groundwater Monitoring Well Installation	Modified Level D
Cap Construction	Modified Level D
Cap Maintenance Activities	Level D with boots and gloves as necessary
Confined Space Entry Activities (if required)	Modified Level D
Groundwater Sampling/Elevation Measurement Activities	Modified Level D
Equipment Cleaning/Decontamination	Modified Level D

Section 6

6. Site Control

6.1 Authorization to Enter

All personnel who are potentially exposed to hazardous substances must have completed hazardous waste operations initial training as defined under OSHA Regulation 29 CFR 1910.120, have completed their training or refresher training within the past 12 months, and have been certified by a physician as fit for hazardous waste operations in order to enter a site area designated as an EZ or CRZ. Personnel without such training or medical certification may enter the designated SZ only. The SS will maintain a list of authorized persons; only personnel on the authorized persons list will be allowed within the EZ or CRZ.

6.2 Site Orientation and Hazard Briefing

No person will be allowed in the general work area during site operations without first being given a site orientation and hazard briefing. This orientation will be presented by the HSS, and will consist of a review of this HASP. This review must cover the chemical, physical, and biological hazards, protective equipment, safe work procedures, and emergency procedures for the project. In addition to this meeting, Daily Safety Meetings will be held each day before work begins.

All people on the site, including visitors, must document their attendance to this briefing as well as the Daily Safety Meetings on the forms included with this plan.

6.3 Certification Documents

A training and medical file may be established for the project and kept on site during all site operations. The 24 or 40-hour training, update, and specialty training [first-aid/cardiopulmonary resuscitation (CPR)] certificates, as well as current medical clearance for all project field personnel, will be maintained within that file. All BBL and subcontractor personnel must provide their training and medical documentation to the HSS prior to the start of field work.

6.4 Entry Log

A log-in/log-out sheet will be maintained at the site by the SS. Personnel must sign in and out on a log sheet as they enter and leave the CRZ, and the SS may document entry and exit in the field notebook..

6.5 Entry Requirements

In addition to the authorization, hazard briefing and certification requirements listed above, no person will be allowed on any BBL field site unless he or she is wearing the minimum SZ PPE as described in Section 5. Personnel entering the EZ or CRZ must wear the required PPE for those locations.

6.6 Emergency Entry and Exit

People who must enter the site on an emergency basis will be briefed of the hazards by the SS. All hazardous activities will cease in the event of an emergency and any sources of emissions will be controlled, if possible.

People exiting the site because of an emergency will gather in a safe area for a head count. The SS is responsible for ensuring that all people who entered the work area have exited in the event of an emergency.

6.7 Contamination Control Zones

Contamination control zones are maintained to prevent the spread of contamination and to prevent unauthorized people from entering hazardous areas.

6.7.1 Exclusion Zone

The EZ consists of the specific work area, or may be the entire area of suspected contamination. All employees entering the EZ must use the required PPE, and must have the appropriate training and medical clearance for hazardous waste work. The EZ is the defined area where there is a possible respiratory and/or contact health hazard. The location of each exclusion zone will be identified by cones, caution tape, or other appropriate means.

6.7.2 Contamination Reduction Zone

The CRZ or transition area will be established, if necessary, to perform decontamination of personnel and equipment. All personnel entering or leaving the EZ will pass through this area to prevent any cross-contamination. Tools, equipment, and machinery will be decontaminated in a specific location. The decontamination of all personnel will be performed on site adjacent to the EZ. Personal protective outer garments and respiratory protection will be removed in the CRZ and prepared for cleaning or disposal. This zone is the only appropriate corridor between the EZ and the SZ.

6.7.3 Support Zone

The SZ is a clean area outside the CRZ located to prevent employee exposure to hazardous substances. Eating and drinking will be permitted in the support area only after proper decontamination. Smoking may be permitted in the SZ, subject to site requirements.

6.7.4 Posting

The EZ, CRZ, and SZ will be prominently marked and delineated using cones, caution tape, or other suitable means.

6.8 Site Inspections

The site supervisor will conduct a daily inspection of site activities, equipment, and zone set up to verify that the required elements are in place. The inspection form in Attachment A may be used as a guide for daily inspections. The form must be completed weekly, and forwarded to the HSS and PM for review.

Section 7

7. Decontamination

7.1 Personnel Decontamination

All personnel wearing Modified Level D or Level C protective equipment in the contaminated zone must undergo personal decontamination prior to entering the SZ. The personnel decontamination area will consist of the following stations.

Station 1: Personnel leaving the contaminated zone will remove the gross contamination from their outer clothing and boots.

Station 2: Personnel will remove their outer garment and gloves and deposit them in the lined waste receptacles. Personnel will then decontaminate their hard hats, and boots with an aqueous solution of detergent or other appropriate cleaning solution. These items are then hand carried to the next station.

Station 3: Personnel will thoroughly wash their hands and face before leaving the decontamination zone. Respirators will be sanitized and then placed in a clean plastic ziplock bag.

7.2 Equipment Decontamination

All vehicles that have entered the contaminated zone will be decontaminated at the decontamination pad prior to leaving the zone. If the level of vehicle contamination is low, decontamination may be limited to rinsing of tires and wheel wells with water. If the vehicle is significantly contaminated, steam cleaning or pressure washing of vehicles and equipment may be required.

7.3 Personal Protective Equipment Decontamination

Where and whenever possible, single use, external protective clothing must be used for work within the EZ or CRZ. This protective clothing must be disposed of in properly labeled containers.

Reusable protective clothing will be rinsed at the site with detergent and water. The rinsate will be collected for disposal.

When removed from the CRZ, the respirator will be thoroughly cleaned with soap and water. The respirator face piece, straps, valves and covers must be thoroughly cleaned at the end of each work shift, and ready for use prior to the next shift. Respirator parts may be disinfected with a solution of bleach and water, or by using a spray disinfectant.

Section 8

8. Site Monitoring

Requirements for personal exposure monitoring are presented in Appendix B, Air Monitoring Plan. The Air Monitoring Plan presents monitoring requirements for both personal exposure to on-site workers and perimeter monitoring requirements.

Section 9

9. Employee Training

9.1 General

All on-site project personnel who work in areas where they may be exposed to site constituents must be trained as required by OSHA Regulation 29 CFR 1910.120. Such field employees also receive a minimum of three days of actual field experience under the direct supervision of a trained, experienced supervisor. Personnel who completed their training more than 12 months prior to the start of the project must have completed an 8-hour refresher course within the past 12 months. The BBL SS must have completed an additional 8 hours of training for supervisors, and must have a current first-aid/CPR certificate.

9.2 Basic 40-Hour Course

The following is a list of the topics typically covered in a 40-hour training course:

- General safety procedures;
- Physical hazards (fall protection, noise, heat stress, cold stress);
- Names and job descriptions of key personnel responsible for site HS;
- Safety, health, and other hazards typically present at hazardous waste sites;
- Use, application and limitations of PPE;
- Work practices by which employees can minimize risks from hazards;
- Safe use of engineering controls and equipment on site;
- Medical surveillance requirements;
- Recognition of symptoms and signs which might indicate overexposure to hazards;
- Worker right-to-know (Hazard Communication OSHA 1910.1200);
- Routes of exposure to constituents;
- Engineering controls and safe work practices;
- Components of a site HS program and HASP;
- Decontamination practices for personnel and equipment;
- Confined-space entry procedures; and
- General emergency response procedures.

9.3 Supervisor Course

Management and supervisors receive an additional eight hours of training which typically includes:

- General site safety and health procedures;
- PPE programs; and
- Air monitoring techniques.

9.4 Site-Specific Training

Site-specific training will be accomplished by each site worker reading this HASP, or through a site briefing by the PM, SS, or HSS on the contents of this HASP before work begins. The review must include a discussion of the chemical, physical, and biological hazards, the protective equipment and safety procedures, and emergency procedures.

9.5 Daily Safety Meetings

Daily Safety Meetings will be held to cover the work to be accomplished, the hazards anticipated, the protective clothing and procedures required to minimize site hazards, and emergency procedures. These meetings should be presented by the SS or HSS prior to beginning the day's field work. No work will be performed in an EZ before the Daily Safety Meeting has been held. The Daily Safety Meeting must also be held prior to new tasks, and repeated if new hazards are encountered. The Daily Safety Meeting Log is included in Attachment G.

9.6 First Aid and CPR

At least two employees current in first aid/CPR will be assigned to the work crew and will be on the site during operations. Refresher training in first aid (triennially) and CPR (annually) is required to keep the certificate current. These individuals must also receive training regarding the precautions and protective equipment necessary to protect against exposure to blood-borne pathogens.

Section 10

10. Medical Surveillance

10.1 Medical Examination

All personnel who are potentially exposed to site constituents must participate in a medical surveillance program as defined by OSHA at 29 CFR 1910.120 (f).

10.1.1 Preplacement Medical Examination

All potentially exposed personnel must have completed a comprehensive medical examination prior to assignment, and periodically thereafter as defined by applicable OSHA Regulations. The preplacement and periodic medical examinations typically include the following elements:

- medical and occupational history questionnaire;
- physical examination;
- complete blood count, with differential;
- liver enzyme profile;
- chest X-ray, at a frequency determined by the physician;
- pulmonary function test;
- audiogram;
- electrocardiogram for persons older than 45 years of age, or if indicated during the physical examination;
- drug and alcohol screening, as required by job assignment;
- visual acuity; and
- follow-up examinations, at the discretion of the examining physician or the corporate medical director.

The examining physician provides the employee with a letter summarizing his findings and recommendations, confirming the worker's fitness for work and ability to wear a respirator. Documentation of medical clearance will be available for each employee during all project site work.

Subcontractors will certify that all their employees have successfully completed a physical examination by a qualified physician. The physical examinations must meet the requirements of 29 CFR 1910.120 and 29 CFR 1910.134. Subcontractors will supply copies of the medical examination certificate for each on-site employee.

10.1.2 Other Medical Examination

In addition to pre-employment, annual, and exit physicals, personnel may be examined:

- at employee request after known or suspected exposure to toxic or hazardous materials;

- at the discretion of the client, HS professional, or occupational physician in anticipation of, or after known or suspected exposure to toxic or hazardous materials; and

- at the discretion of the occupational physician.

10.1.3 Periodic Exam

Following the placement examination, all employees must undergo a periodic examination, similar in scope to the placement examination. For employees potentially exposed over 30 days per year, the frequency of periodic examinations will be annual. For employees potentially exposed less than 30 days per year, the frequency for periodic examinations will be 18 months.

10.2 Medical Restriction

When the examining physician identifies a need to restrict work activity, the employee's supervisor must communicate the restriction to the employee and the HSS. The terms of the restriction will be discussed with the employee and the supervisor.

Section 11

11. Emergency Procedures

11.1 General

Prior to the start of operations, the work area will be evaluated for the potential for fire, constituent release, or other catastrophic event. Unusual conditions or events, activities, chemicals, and conditions will be reported to the SS/HSS immediately.

The SS/HSS will establish evacuation routes and assembly areas for the site. All personnel entering the site will be informed of this route and the assembly area.

11.2 Emergency Response

If an incident occurs, the following steps will be taken:

- the SS/HSS will evaluate the incident and assess the need for assistance and/or evacuation;
- the SS/HSS will call for outside assistance as needed;
- the SS/HSS will ensure the PM is notified promptly of the incident; and
- the SS/HSS will take appropriate measures to stabilize the incident scene.

11.2.1 Fire

In the case of a fire on the site, the SS/HSS will assess the situation and direct fire-fighting activities. The SS/HSS will ensure that the client site representative (as appropriate) is immediately notified of any fires. Site personnel will attempt to extinguish the fire with available extinguishers, if safe to do so. In the event of a fire that site personnel are unable to safely extinguish, the local fire department will be summoned.

11.2.2 Constituent Release

In the event of a constituent release, the following steps will be taken:

- notify SS/HSS immediately;
- evacuate immediate area of release;
- conduct air monitoring to determine needed level of PPE; and
- don required level of PPE and prepare to implement control procedures.

The SS/HSS has the authority to commit resources as needed to contain and control released material and to prevent its spread to off-site areas.

11.3 Medical Emergency

All employee injuries must be promptly reported to the HSS/SS, who will:

- ensure that the injured employee receives prompt first aid and medical attention;

- in emergency situations, the worker is to be transported by appropriate means to the nearest urgent care facility (normally a hospital emergency room); and

- EMR is to be notified by site personnel as soon as possible after the worker has left the site. The caller should dial 1-800-229-3674 and follow the instructions for reaching the Injury Management office. When the Case Manager answers, the caller should provide the information requested by the Case Manager.

11.3.1 First Aid - General

All persons must report any near-miss incident, accident, injury, or illness to their immediate supervisor or the SS. First aid will be provided by trained personnel. Injuries and illnesses requiring medical treatment must be documented. The SS must conduct an accident investigation as soon as emergency conditions no longer exist and first-aid and/or medical treatment has been ensured. These two reports must be completed and submitted to the PM within 24 hours after the incident.

If first-aid treatment is required, first aid kits are kept at the CRZ. If treatment beyond first aid is required, the injured should be transported to the medical facility. If the injured is not ambulatory, or shows any sign of not being in a comfortable and stable condition for transport, then an ambulance/paramedics should be summoned. If there is any doubt as to the injured worker's condition, it is best to let the local paramedic or ambulance service examine and transport the worker.

- *Survey the scene.* Determine if it is safe to proceed. Try to determine if the conditions which caused the incident are still a threat. Protect yourself from exposure before attempting to rescue the victim.

- *Do a primary survey of the victim.* Check for airway obstruction, breathing, and pulse. Assess likely routes of chemical exposure by examining the eyes, mouth, nose, and skin of the victim for symptoms.

- *Phone Emergency Medical Services (EMS).* Give the location, telephone number used, caller's name, what happened, number of victims, victims' condition, and help being given.

- *Maintain airway and perform rescue breathing* as necessary.

- *Perform cardiopulmonary resuscitation (CPR)* as necessary.

- *Do a secondary survey of the victim.* Check vital signs and do a head-to-toe exam.

- *Treat other conditions as necessary.* If the victim can be moved, take him to a location away from the work area where EMS can gain access.

11.3.2 First Aid - Inhalation

Any employee complaining of symptoms of chemical overexposure as described in Section 3 will be removed from the work area and transported to the designated medical facility for examination and treatment.

11.3.3 First Aid - Ingestion

Call EMS and consult a poison control center for advice. If available, refer to the MSDS for treatment information, if recommended. If unconscious, keep the victim on his side and clear the airway if vomiting occurs.

11.3.4 First Aid - Skin Contact

Project personnel who have had skin contact with constituents will, unless the contact is severe, proceed through the decontamination zone, to the wash-up area. Personnel will remove any contaminated clothing, and then flush the affected area with water for at least 15 minutes. The worker should be transported to the medical facility if he shows any sign of skin reddening, irritation, or if he requests a medical examination.

11.3.5 First Aid - Eye Contact

Project personnel who have had constituents splashed in their eyes or who have experienced eye irritation while in the contaminated zone, must immediately proceed to the eyewash station, set up in the decontamination zone. Do not decontaminate prior to using the eyewash. Remove whatever protective clothing is necessary to use the eyewash. Flush the eye with clean running water for at least 15 minutes. Arrange prompt transport to the designated medical facility.

11.4 Reporting Injuries and Illnesses

All injuries and illnesses, however minor, will be reported to the SS immediately. The SS will complete an injury report (Attachment H) and submit it to the PM within 24 hours.

11.5 Emergency Information

The means to summon local public response agencies such as police, fire, and ambulance will be reviewed in the Daily Safety Meeting. These agencies are identified in the following table.

TABLE 11-1
EMERGENCY CONTACTS

	Phone Number	Location
1. Local Emergency Contacts		
Emergency City of Buffalo		
- Police Department	911 or 716-851-4411	
- Fire Department	911 or 716-856-5111	
Emergency Erie County		
- Sheriffs Department	716-662-5554	
- Health Department	716-858-7690 (business hours)	Orchard Park, New York
	716-898-4225 (after 5 p.m.)	Buffalo, New York
Emergency New York State		
- State Police	716-759-6831	Clarence, New York
- Health Department	716-847-4500	Buffalo, New York
- NYSDEC Region 9 Office Division of Environmental Remediation	716-851-7220	Region 9, New York
2. Medical Emergency Contacts		
Sheehan Memorial Hospital	716-842-2200	Emergency
Buffalo General Hospital	716-845-2210	
Ambulance Services (24 hour)	911 or 716-882-8400	LaSalle Ambulance Service
	716-881-1717	Gold Cross Ambulance Service, Inc.
3. National Organizations		
EPA Region II, Health and Safety	908-321-6789	New Jersey (business hours)
	908-548-8730	(after business hours)
USEPA, Emergency Res. Team	201-321-6660	New Jersey
EPA, Superfund/RCRA	800-424-9346	
	202-382-3000	
EPA, TSCA	800-424-9065	
	202-554-1404	
EPA, Occupational Health and Safety	202-382-3648	
NIOSH, Health Hazard Eval.	513-684-4382	
OSHA, Technical Data Center	202-523-9700	
OSHA, Health Response Team	801-524-5896	
OSHA	716-684-3891	Buffalo, New York
US Coast Guard,	800-424-8802	Washington, D.C.
National Response Team	202-267-2675	
CHEMTREC, Chem. Emergencies	800-424-9300	
Emergency Response		
National Foam Center,	215-363-1400	Pennsylvania

Note: See Table 2-1 of this HASP for telephone numbers of key client and BBL personnel associated with this project.

ATTACHMENT A
SAFETY INSPECTION FORM

DAILY HEALTH AND SAFETY CHECKLIST

Site Name: _____ Date: _____ Project #: _____

HSS or Designated Alternate: _____

FORWARD A COPY OF COMPLETED FORM TO THE HEALTH AND SAFETY MANAGER

	Yes	No	N/A	Comments (Use back of form if more space is needed)
1. Safety meeting held today?				
2. Emergency procedures discussed during safety meeting?				
3. Vehicle available on-site for transporation to the hospital?				
4. At least one person trained in CPR and first-aid on-site?				
5. Proper PPE being worn as specified in the HASP?				
Level of PPE being worn: _____				
6. PPE adequate for work conditions?				
If not, give reason: _____				
Upgrade/downgrade to PPE level: _____				
7. If Level B, back-up/emergency person suited up (except for air)?				
8. Monitoring equipment calibrated?				
9. Monitoring equipment in good condition?				
10. Monitoring equipment used properly?				
11. Other monitoring equipment needed?				
List: _____				
12. Monitoring equipment covered with plastic to minimize contamination?				
13. Decon line set up properly?				
14. Proper cleaning fluid used for known or suspected contaminants?				
15. Proper decon procedures used?				
16. Decon personnel wearing proper PPE?				
17. Equipment decontaminated?				
18. Sample containers decontaminated?				
19. Disposable items changed twice a day or more often if needed?				
20. Proper collection and disposal of potentially contaminated PPE?				
21. Proper collection and disposal of decon fluid?				
22. Buddy system used?				
23. Equipment kept off drums and ground?				
24. Kneeling or sitting on drums or ground prohibited?				
25. Personnel avoid standing or walking through puddles or stained soil?				
26. Work zones established?				
27. If night work is conducted, is adequate illumination provided?				
28. Smoking, eating, or drinking in the Exclusion Zone or CRZ prohibited?				
29. To the extent feasible, contaminated materials handled remotely?				
30. Entry into excavations prohibited unless properly shored or sloped?				
31. All unusual situations on-site listed in HASP?				
If not, what? _____				
Action taken? _____				
HASP revised? _____				
32. All confined spaces identified?				
If not, list: _____				
33. Confined Space Checklists used?				
34. Confined Space Checklists completely and correctly filled out?				

ATTACHMENT B
29 CFR 1926 SUBPART P: APPENDIX A

OSHA Occupational Safety & Health Administration U.S. Department of Labor

OSHA Regulations (Standards - 29 CFR)

Soil Classification - 1926 Subpart P App A

OSHA Regulations (Standards - 29 CFR) - Table of Contents

- **Standard Number:** 1926 Subpart P App A
- **Standard Title:** Soil Classification
- **SubPart Number:** P
- **SubPart Title:** Excavations

(a) Scope and application - (1) Scope. This appendix describes a method of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits. The appendix contains definitions, sets forth requirements, and describes acceptable visual and manual tests for use in classifying soils.

(2) Application. This appendix applies when a sloping or benching system is designed in accordance with the requirements set forth in 1926.652(b)(2) as a method of protection for employees from cave-ins. This appendix also applies when timber shoring for excavations is designed as a method of protection from cave-ins in accordance with appendix C to subpart P of part 1926, and when aluminum hydraulic shoring is designed in accordance with appendix D. This Appendix also applies if other protective systems are designed and selected for use from data prepared in accordance with the requirements set forth in 1926.652(c), and the use of the data is predicated on the use of the soil classification system set forth in this appendix.

(b) Definitions. The definitions and examples given below are based on, in whole or in part, the following; American Society for Testing Materials (ASTM) Standards D653-85 and D2488; The Unified Soils Classification System; The U.S. Department of Agriculture (USDA) Textural Classification Scheme; and The National Bureau of Standards Report BSS-121.

"Cemented soil" means a soil in which the particles are held together by a chemical agent, such as calcium carbonate, such that a hand-size sample cannot be crushed into powder or individual soil particles by finger pressure.

"Cohesive soil" means clay (fine grained soil), or soil with a high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical sideslopes, and is plastic when moist. Cohesive soil is hard to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clayey silt, sandy clay, silty clay, clay and organic clay.

"Dry soil" means soil that does not exhibit visible signs of moisture content.

"Fissured" means a soil material that has a tendency to break along definite planes of fracture with little resistance, or a material that exhibits open cracks, such as tension cracks, in an exposed surface.

"Granular soil" means gravel, sand, or silt (coarse grained soil) with little or no clay content. Granular soil has no cohesive strength. Some moist granular soils exhibit apparent cohesion. Granular soil cannot be molded when moist and crumbles easily when dry.

"Layered system" means two or more distinctly different soil or rock types arranged in layers. Micaceous seams or weakened planes in rock or shale are considered layered.

"Moist soil" means a condition in which a soil looks and feels damp. Moist cohesive soil can easily be shaped into a ball and rolled into small diameter threads before crumbling. Moist granular soil that contains some

cohesive material will exhibit signs of cohesion between particles.

"Plastic" means a property of a soil which allows the soil to be deformed or molded without cracking, or appreciable volume change.

"Saturated soil" means a soil in which the voids are filled with water. Saturation does not require flow. Saturation, or near saturation, is necessary for the proper use of instruments such as a pocket penetrometer or sheer vane.

"Soil classification system" means, for the purpose of this subpart, a method of categorizing soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B, and Type C, in decreasing order of stability. The categories are determined based on an analysis of the properties and performance characteristics of the deposits and the characteristics of the deposits and the environmental conditions of exposure.

"Stable rock" means natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

"Submerged soil" means soil which is underwater or is free seeping.

"Type A" means cohesive soils with an unconfined, compressive strength of 1.5 ton per square foot (tsf) (144 kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if:

(i) The soil is fissured; or

(ii) The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or

(iii) The soil has been previously disturbed; or

(iv) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or

(v) The material is subject to other factors that would require it to be classified as a less stable material.

"Type B" means:

(i) Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or

(ii) Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.

(iii) Previously disturbed soils except those which would otherwise be classed as Type C soil.

(iv) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or

(v) Dry rock that is not stable; or

(vi) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

"Type C" means:

(i) Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less; or

(ii) Granular soils including gravel, sand, and loamy sand; or

(iii) Submerged soil or soil from which water is freely seeping; or

(iv) Submerged rock that is not stable, or

(v) Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

"Unconfined compressive strength" means the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, or estimated in the field using a pocket penetrometer, by thumb penetration tests, and other methods.

"Wet soil" means soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. Granular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.

(c) Requirements - (1) Classification of soil and rock deposits. Each soil and rock deposit shall be

classified by a competent person as Stable Rock, Type A, Type B, or Type C in accordance with the definitions set forth in paragraph (b) of this appendix.

(2) Basis of classification. The classification of the deposits shall be made based on the results of at least one visual and at least one manual analysis. Such analyses shall be conducted by a competent person using tests described in paragraph (d) below, or in other recognized methods of soil classification and testing such as those adopted by the American Society for Testing Materials, or the U.S. Department of Agriculture textural classification system.

(3) Visual and manual analyses. The visual and manual analyses, such as those noted as being acceptable in paragraph (d) of this appendix, shall be designed and conducted to provide sufficient quantitative and qualitative information as may be necessary to identify properly the properties, factors, and conditions affecting the classification of the deposits.

(4) Layered systems. In a layered system, the system shall be classified in accordance with its weakest layer. However, each layer may be classified individually where a more stable layer lies under a less stable layer.

(5) Reclassification. If, after classifying a deposit, the properties, factors, or conditions affecting its classification change in any way, the changes shall be evaluated by a competent person. The deposit shall be reclassified as necessary to reflect the changed circumstances.

(d) Acceptable visual and manual tests. - (1) Visual tests. Visual analysis is conducted to determine qualitative information regarding the excavation site in general, the soil adjacent to the excavation, the soil forming the sides of the open excavation, and the soil taken as samples from excavated material.

(i) Observe samples of soil that are excavated and soil in the sides of the excavation. Estimate the range of particle sizes and the relative amounts of the particle sizes. Soil that is primarily composed of fine-grained material material is cohesive material. Soil composed primarily of coarse-grained sand or gravel is granular material.

(ii) Observe soil as it is excavated. Soil that remains in clumps when excavated is cohesive. Soil that breaks up easily and does not stay in clumps is granular.

(iii) Observe the side of the opened excavation and the surface area adjacent to the excavation. Crack-like openings such as tension cracks could indicate fissured material. If chunks of soil spall off a vertical side, the soil could be fissured. Small spalls are evidence of moving ground and are indications of potentially hazardous situations.

(iv) Observe the area adjacent to the excavation and the excavation itself for evidence of existing utility and other underground structures, and to identify previously disturbed soil.

(v) Observed the opened side of the excavation to identify layered systems. Examine layered systems to identify if the layers slope toward the excavation. Estimate the degree of slope of the layers.

(vi) Observe the area adjacent to the excavation and the sides of the opened excavation for evidence of surface water, water seeping from the sides of the excavation, or the location of the level of the water table.

(vii) Observe the area adjacent to the excavation and the area within the excavation for sources of vibration that may affect the stability of the excavation face.

(2) Manual tests. Manual analysis of soil samples is conducted to determine quantitative as well as qualitative properties of soil and to provide more information in order to classify soil properly.

(i) Plasticity. Mold a moist or wet sample of soil into a ball and attempt to roll it into threads as thin as 1/8-inch in diameter. Cohesive material can be successfully rolled into threads without crumbling. For example, if at least a two inch (50 mm) length of 1/8-inch thread can be held on one end without tearing, the soil is cohesive.

(ii) Dry strength. If the soil is dry and crumbles on its own or with moderate pressure into individual grains or fine powder, it is granular (any combination of gravel, sand, or silt). If the soil is dry and falls

into clumps which break up into smaller clumps, but the smaller clumps can only be broken up with difficulty, it may be clay in any combination with gravel, sand or silt. If the dry soil breaks into clumps which do not break up into small clumps and which can only be broken with difficulty, and there is no visual indication the soil is fissured, the soil may be considered unfissured.

(iii) Thumb penetration. The thumb penetration test can be used to estimate the unconfined compressive strength of cohesive soils. (This test is based on the thumb penetration test described in American Society for Testing and Materials (ASTM) Standard designation D2488 - "Standard Recommended Practice for Description of Soils (Visual - Manual Procedure).") Type A soils with an unconfined compressive strength of 1.5 tsf can be readily indented by the thumb; however, they can be penetrated by the thumb only with very great effort. Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb, and can be molded by light finger pressure. This test should be conducted on an undisturbed soil sample, such as a large clump of spoil, as soon as practicable after excavation to keep to a minimum the effects of exposure to drying influences. If the excavation is later exposed to wetting influences (rain, flooding), the classification of the soil must be changed accordingly.

(iv) Other strength tests. Estimates of unconfined compressive strength of soils can also be obtained by use of a pocket penetrometer or by using a hand-operated shearvane.

(v) Drying test. The basic purpose of the drying test is to differentiate between cohesive material with fissures, unfissured cohesive material, and granular material. The procedure for the drying test involves drying a sample of soil that is approximately one inch thick (2.54 cm) and six inches (15.24 cm) in diameter until it is thoroughly dry:

(A) If the sample develops cracks as it dries, significant fissures are indicated.

(B) Samples that dry without cracking are to be broken by hand. If considerable force is necessary to break a sample, the soil has significant cohesive material content. The soil can be classified as an unfissured cohesive material and the unconfined compressive strength should be determined.

(C) If a sample breaks easily by hand, it is either a fissured cohesive material or a granular material. To distinguish between the two, pulverize the dried clumps of the sample by hand or by stepping on them. If the clumps do not pulverize easily, the material is cohesive with fissures. If they pulverize easily into very small fragments, the material is granular.

OSHA Regulations (Standards - 29 CFR) - Table of Contents

ATTACHMENT C
BBL CONFINED SPACE ENTRY PPM

BBL	TOPIC: CONFINED SPACE ENTRY	PPM#: 1.02.08
Policy & Procedure Memo	SECTION: Health & Safety	COMPANY LOCATIONS AFFECTED: All

STATEMENT OF POLICY:

The Firm is committed to operate in a manner that will protect the health and safety of its employees. Employees of the Firm will abide by applicable local, state, and federal regulations while conducting activities for the Firm. Entry into enclosed or confined areas presents unique hazards to employees of the Firm. To reduce the potential for injury, personnel will avoid entering confined spaces whenever feasible. If entry is required into a confined space, the safety and engineering controls outlined in this procedure must be implemented by authorized personnel prior to entry.

To effectively mitigate or eliminate the hazards presented by entry into confined spaces, this procedure sets forth the accepted practice for confined space entry and establishes the requirement for a Confined Space Entry Permit protocol. This procedure, protocol, and Confined Space Entry Permit and Checklist applies to all employees of the Firm. Only trained and authorized personnel are permitted to enter confined spaces, supervise confined space activities, and perform rescue from confined spaces.

DESCRIPTION OF PROCEDURE:

1. **DEFINITIONS**

A. Attendant means a trained authorized individual stationed outside the confined space who's sole duty is to monitor authorized entrants inside the confined space.

B. Confined space means any enclosed space which is large enough and so configured that an employee can bodily enter and perform work, has limited or restricted means for entry or exit, and is not intended for continuous employee occupancy. Confined spaces include, <u>but are not limited to</u>, storage tanks, vessels, pits, boilers, flues, manholes, ventilation system duct work, sewers, vaults, pipelines, silos, storage hoppers, and diked areas.

1) **Permit-required confined space (permit space)** means a confined space that has one or more of the following characteristics:

a) Contains or has a known potential to contain a hazardous atmosphere;

b) Contains a material with the potential for engulfment of an entrant;

c) Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls, or a floor which slopes downward and tapers to a smaller cross-section; and/or

d) Contains any recognized safety or health hazard capable of causing injury or death.

2) **A Non-permit confined space** means a confined space that does not contain or have the potential to contain any hazards capable of causing death or serious physical harm.

C. **Entry** means the act by which a employee intentionally passes through an opening into a permit-required confined space. Entry is considered to have occurred as soon as any part of the employee's body breaks the plane of the opening into the space.

D. **Entry Permit** means the document which defines the conditions of confined space entry, the reasons for entering the confined space, the anticipated hazards of the entry, a listing of atmospheric monitoring equipment and acceptable atmospheric conditions. The entry permit identifies the rescue and other contacts which must be summoned in the case of an emergency, provides a listing of authorized attendants and entrants, the date of entry to the confined space, and the expiration of the entry permit. For the purposes of this PPM, the Confined Space Entry Permit consists of both the Confined Space Entry Permit and the Confined Space Entry Checklist and/or the Confined Space Entry Permit and the Sewer System Manhole Entry Checklist **{Copies of the Confined Space Entry Permit and Checklist follow this procedure}.**

E. **Entry Supervisor** means the trained, authorized employee responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, for authorizing entry and overseeing entry operations, and for terminating entry. The entry supervisor may also serve as an authorized attendant.

F. **Entrant** means an employee who is trained and authorized to enter a confined space.

G. **Hazardous atmosphere** means an atmosphere which exposes employees to a risk of death, incapacitation, injury or acute illness from one or more of the following:

1) An atmospheric concentration of any substance in excess of 50% of its established permissible exposure limit (PEL), or in absence of a PEL, its assigned threshold limit value (TLV), or other value listed on the Material Safety Data Sheet (MSDS) for the chemical constituent;

2) A flammable gas, vapor, or mist in excess of 10 percent (%) of its lower explosive limit (LEL);

3) An airborne combustible dust at a concentration that obscures vision at a distance of 5 feet or less;

4) An atmospheric oxygen concentration below 19.5% (oxygen deficient atmosphere) or above 23.5% (oxygen enriched atmosphere); and/or

5) An atmosphere which is immediately dangerous to life and health.

H. **Immediately dangerous to life and health (IDLH)** means any condition which poses an immediate threat to loss of life; may result in irreversible or immediate-severe health effects; may result in eye damage, irritation or other conditions which could impair escape from the confined space.

I. **Isolation** means removing equipment/systems in and around the space from service. This includes lockout and tagout, double blanking and bleeding, disconnecting, and securing or restraining equipment.

2. RESPONSIBILITIES

A. Officers/Division Heads/Project Managers have the following responsibilities:

1) Verify that all confined spaces and entry protocols are properly identified and addressed within the project work plan, project health & safety plan, and/or other project related documents.

2) Verify that their Divisional employees have received the proper confined space training provided by Corporate Health & Safety prior to conducting confined space entry activities.

3) Verify that the proper confined space entry equipment, including personal protective equipment, atmospheric testing equipment, and safety equipment, is available for use by their Divisional employees.

B. Corporate Health & Safety has the following responsibilities:

1) Provide the initial confined space entry training and retraining, as needed, to all entry supervisors, entrants and attendants;

2) Provide technical assistance regarding confined space entry protocol, atmospheric testing equipment, personal protective equipment, hazard assessment, and research information on unusual hazards;

3) Audit project specific confined space entry for compliance with this PPM;

4) Retain a file of cancelled Confined Space Entry Permits for annual review; and

5) Conduct annual review of this PPM and all cancelled permits.

C. The Divisional Health & Safety Coordinators (HSC) have the following responsibilities:

1) Review this PPM with all trained entrants and attendants on a project specific basis;

2) Verify that all entry supervisors, entrants and attendants have received the training offered by Corporate Health & Safety prior to conducting confined space entry activities;

3) Review completed entry permits and verify that the project specific entry supervisor fulfills his/her responsibilities (listed in D below) and properly completes the Entry Permit; and

4) Verify that copies of the completed and canceled Confined Space Entry Permit are properly disseminated and retained with the project files as specified in Section 13-Posting and Recordkeeping.

D. Entry supervisors (also see Training and Duties of Entry Supervisor) have the following responsibilities:

1) Interface with the client representative to identify hazards associated with the client's confined space;

2) Review existing confined space data (if any) recorded by the client;

3) Review the client's confined space procedure;

4) Review the lock-out/tag-out and isolation measures implemented by the client;

5) Immediately report any unusual or unforeseen confined space entry hazard to both the Divisional HSC, Regional Health and Safety Coordinator, or Corporate Industrial Hygiene/Environmental Safety Associate prior to authorizing entry;

6) Verify that all tests and precautionary measures identified on the permit have been performed prior to authorizing the entry permit;

7) Issue, authorize, and post the Entry Permit prior to any confined space entry; and

8) Upon completion of the entry covered by the permit, and after all entrants have exited the permit space, cancel the Entry Permit.

E. Employees of the Firm have the following responsibilities:

1) Receive the initial training provided by Corporate Health & Safety;

2) Participate in entry operations only if trained and authorized to do so;

3) Never enter a confined space without an authorized attendant, entry supervisor, and an Entry Permit;

4) Never attempt entry rescue within a confined space, unless trained in entry rescue; and

5) If unexpected conditions arise during entry, immediately evacuate the space and inform the entry supervisor.

3. CONFINED SPACE ENTRY PERMIT

A. Prior to entry into any identified confined space, the entry supervisor must complete and sign the Entry Permit as defined above.

B. A separate Entry Permit must be generated for each confined space.

C. A single Entry Permit may be generated for entry into multiple sewer system manholes in a continuous sewer system.

The Confined Space Checklist and/or the Sewer System Manhole Entry Checklist must be completed, signed, and attached as part of the entry permit. As example, for entry into several separate manholes for the purpose of collecting effluent samples, recording water depth, flow, etc., one Entry Permit may be generated for entry into all project specific manholes. The permit must, however, be accompanied by the Sewer System Manhole Entry Checklist which will facilitate entry into as many as 20 manholes per checklist.

D. The completed and signed Entry Permit and Checklist is valid for one shift only. A new completed and signed Entry Permit must be issued for each new crew of entrants and attendants.

E. All entrants must be evacuated and the Entry Permit must be revoked whenever conditions in the space are no longer acceptable as indicated by the direct reading instruments being used to monitor atmospheric conditions in the confined space or some other circumstance either within or outside the confined space.

4. ENTRY PERMIT PROGRAM

A. Prior to authorizing the Entry Permit, the entry supervisor must verify that the confined space has been properly isolated, ventilated, and tested, and that the Confined Space Checklist or Sewer System Manhole Entry Checklist is completed. In completing the appropriate Checklist, the following items are required:

1) All mechanical apparatus (such as agitators) within or connected to the confined space must be de-energized, locked-out, and tagged. This specific activity may be performed by the client, therefore the entry supervisor must review the lock-out procedure with the client and place a separate lock(s) on all multiple lock-out devices. The entry supervisor must retain possession of the key(s) during the entire confined space entry.

2) All lines connected to the confined space where the nature of the service could present a hazard, such as nitrogen, steam, solvent, acid, or hot water, must be isolated from the confined space. Acceptable isolation methods include removing a valve, spool piece, or expansion joint, and blanking or capping the opened end; inserting a suitable full-pressure blank in the piping between connecting flanges; and/or closing and locking at least two valves in the pipeline and locking open to atmosphere a chain valve between the two closed and locked valves. As in #1 above, this activity may be performed by the client. The entry supervisor must review the isolation/blanking and lock-out procedure with the client. The entry supervisor must attach separate lock(s) to any lock-out device installed. The entry supervisor must retain possession of the key(s) during the entire confined space entry.

3) All electrical equipment around and in the confined space must be deenergized and locked out.

4) For confined spaces which have contained a known hazardous chemical, eg., vessels, storage tanks, etc., the client must verify that the vessel has been thoroughly cleaned by appropriate means, eg., overflowing with water, steaming, etc.

5) For confined spaces containing known atmospheric hazards, mechanical ventilation may be utilized to maintain atmospheric hazards within permit parameters. Section 11 - Mechanical Ventilation lists the procedure for confined space ventilation.

6) The atmosphere of the confined space must be initially checked to verify that it contains an acceptable level of oxygen (19.5 to 23.5%) and is free of combustible or toxic gases or vapors. Section 10-Atmospheric Testing of this procedure lists the air quality specifications which must be met. These specifications are also listed on the Entry Permit. Continuous air monitoring may be required, depending on the nature of the confined space as well as the activity(ies) to be conducted within the confined space.

7) Verify that all necessary entry equipment, eg., retrieval lines, personal protective equipment, respiratory protective equipment, etc., are available, in good condition, and functional.

8) Verify that all entrants and attendants have received the appropriate confined space entry training.

9) Verify that all rescue arrangements are in-place as per Section 9-Outside Rescue Assistance, and that an adequate means of communicating with outside assistance is immediately available to the attendant.

B. The Entry Permit must be canceled and all entrants ordered to evacuate the confined space when any one of the following conditions arises:

1) A change in initial atmospheric conditions which may jeopardize the continued safety and health of entrants is detected;

2) The attendant must leave the work station;

3) The attendant is called on to perform duties which do not allow him/her to fulfill his/her duties as an attendant;

4) Whenever ordered by the attendant due to factors external to the confined space which may jeopardize the continued safety and health of entrants;

5) At the end of the work shift and/or whenever a different group of entrants and attendants will take charge of the confined space;

6) Whenever entrants self-perceive danger and self-initiate evacuation;

7) At the termination of confined space entry; and

8) At the end of the workshift in which the entry occurs.

5. TRAINING AND DUTIES OF ENTRY SUPERVISOR

A. 29 CFR 1910.146-Permit Required Confined Spaces assigns specific responsibilities to the client (client or owner of the confined space). These responsibilities include communicating pertinent information regarding the hazards associated with their identified confined space(s) to contractor employees who will enter those spaces. In order to verify that the required information regarding the confined space is properly communicated to employees of the Firm, the entry supervisor must:

1) Investigate the clients' permit entry protocol, ensuring that any identified hazards and previous experience with the confined space is properly communicated;

2) Coordinate rescue assistance with either the client's in-house rescue team and/or the off-site rescue assistance specified by the client. The off-site rescue assistance specified by the client must have direct experience in rescue in the clients' identified confined space; or be provided an opportunity to examine the space and practice a rescue.

3) Verify that the client takes the necessary precautions in notifying their employees that our employees will be entering the confined space;

4) Coordinate entry operations with the employees of the client when both client and employees of the Firm will be working in or near a permit space; and,

5) Inform the client of this permit space program and any additional precautions that will be taken by employees of the Firm during the entry procedure.

B. In addition to acting as the liaison with the client representative, the entry supervisor has the following assigned duties:

1) Recognize the hazards involved with the entry as well as the signs and symptoms of exposure to the hazards;

2) Verify the that both the entry permit and checklist are completed and required equipment is in use prior to entry; and,

3) Monitor entry operations and verify that they remain consistent with the terms of the entry permit and that acceptable entry conditions are maintained.

C. The entry supervisor may also function as either the attendant and/or as an entrant, therefore, the entry supervisor must have the training specified for an attendant and/or an entrant, and will assume the duties listed below for either the attendant and/or the entrant.

6. TRAINING AND DUTIES OF AUTHORIZED ENTRANTS

A. Entrants must have training and instruction in their duties and responsibilities regarding confined space entry. The following are assigned duties:

1) Recognize the hazards which may be faced during entry, as well as the signs and symptoms of exposure to the hazard(s);

2) Maintain visual contact and/or verbal communications with the attendant at all times;

3) Use the personal protective equipment (PPE) provided;

4) Maintain an awareness of all external barriers required to protect from external hazards, eg., blanking, blocking, lockout, etc., and the proper use of those barriers; and

5) Obey evacuation orders given by either the attendant, entry supervisor, automatic alarm activation, or when self-perceived.

7. TRAINING AND DUTIES OF ATTENDANTS

A. An attendant must be stationed and remain stationed outside the permit space at all times during entry operations. The attendant may have no other duties besides those listed in this section.

B. All attendants must have training and instruction in their duties and responsibilities regarding confined space entry. The following are assigned duties:

1) Maintain an accurate count of all entrants in the confined space;

2) Monitor activities both inside and outside the confined space to verify the continued safety of entrants;

3) Maintain visual contact or verbal communications with all entrants in the confined space at all times;

4) Order evacuation of the confined space if an uncontrolled hazard develops, either within or outside the confined space, or upon observing a behavioral effect of hazard exposure among entrants;

5) Warn unauthorized persons away from the confined space;

6) Participate in non-entry rescue; and

7) Summon rescue and other emergency services.

D. Attendants must maintain current certification in basic first aid and cardiopulmonary resuscitation (CPR).

E. **Under no circumstances should the attendant attempt rescue of entrants by entering the confined space.**

8. TRAINING CERTIFICATION

A. Training provided to the entry supervisor, attendant, and entrant must be certified by the Firm. Such training certification will be provided by Corporate Health & Safety.

B. Documentation of training certification received by attendance at an outside training course must be provided to Corporate Health & Safety.

9. OUTSIDE RESCUE ASSISTANCE

A. For any project involving a confined space entry, the entry supervisor must address rescue coordination efforts. Such rescue assistance must be coordinated with either the client's designated confined space rescue team and/or with a local emergency response team.

B. Confined space entry shall progress only after proper notification of outside rescue assistance prior to the actual entry activity.

C. An adequate means of communication., eg., cellular telephone for contacting off-site emergency assistance, air horn or two-way radio for summoning a client's rescue team, etc., must be immediately available to the attendant.

10. ATMOSPHERIC TESTING

A. All confined spaces will be tested for atmospheric hazards as follows:

1) Each confined space will initially be tested prior to the entry supervisor authorizing entry.

2) Each confined space will also be tested continuously or at intervals as specified by the entry supervisor.

B. The Entry Supervisor will select continuous or interval monitoring, and specify length of the interval to be implemented during entry. Selection of continuous or interval monitoring will be based on the nature of the confined space hazards present in the permit space, activity during entry, and potential for hazards developing in the confined space.

C. All confined spaces must be tested for atmospheric hazards prior to each entry, and as entry proceeds. **The following are the testing sequence and acceptable air quality criteria:**

1) Oxygen content for all confined space entry must be 19.5 to 23.5%;

2) Combustible gas or vapor must not exceed 10% of its lower explosive limit (LEL);

3) Toxic gas or vapor must not exceed 50% of the Permissible Exposure Limit (PEL) or other published exposure guideline;

4) Carbon monoxide must not exceed 20 ppm; and

5) Hydrogen sulfide must not exceed 5 ppm.

D. If it is necessary to enter a confined space where any of the following atmospheric conditions exists, all entrants must wear either a self-contained breathing apparatus (SCBA) of at least 60-minute duration or an air line respirator with emergency SCBA:

1) Initial atmospheric testing indicates conditions outside the parameters listed on the Entry Permit;

2) Initial atmospheric testing indicates conditions within permit parameters but where the quality of the atmosphere remains questionable; and/or

3) Despite initial atmospheric testing results, activities to be performed while in the confined space would endanger entrants by a creating a sudden change in atmospheric conditions within the space.

4) Mechanical ventilation will not maintain atmospheric hazards within permit limits.

E. Under **no** circumstances is entry into a confined space having an IDLH condition (less than 19.5% oxygen or > 10% LEL) permitted by any employee of the Firm.

F. Results of all atmospheric testing must be recorded on the Confined Space Entry Permit.

11. MECHANICAL VENTILATION

A. Mechanical ventilation may be utilized to maintain confined space atmospheric hazards within entry limits.

B. Ventilation can be used to force clean air into a confined space or to remove contaminated air from the confined space.

C. Ventilation systems must be set up to adequately ventilate all areas of the confined space.

D. Ventilation systems must be locked in the "on" position. The confined space must have evacuated if the system fails.

E. **Continuous air monitoring must be implemented when ventilation is utilized to maintain atmospheric** hazards within entry permit limits.

F. Air intake must be positioned to prevent the introduction of air contamination into the confined space (i.e. away from vehicle exhaust, tank vents, etc.).

12. WORK PRACTICES

A. All entrants must wear a retrieval line secured on one end to the entrant by a full-body harness, or parachute harness, and the end secured outside the space for vertical-entry confined spaces, the lifeline must be secured to a lifting or other mechanical retrieval device. **Reliance on manually lifting an entrant from a vertical confined space is prohibited.** If more than one entrant is entering the space, each line shall be clearly marked to identify the entrant and the mechanical retrieve system must be rated for multiple entrant use.

B. Where mechanical ventilation will be relied upon for eliminating an actual or potential hazardous atmosphere, the atmosphere of the space must be continually monitored to verify that the continuous forced air ventilation is preventing the generation or accumulation of a hazardous atmosphere.

C. Whenever a ladder is required for confined space entry, the ladder must be secured and not withdrawn while anyone remains within the confined space except as necessary to permit extraction during rescue.

D. Adequate illumination must be provided for all confined space entry. An approved type (explosion-proof) lighting device must be used.

E. All electrical equipment used within a confined space must be explosion-proof and must be inspected prior to use to verify good working condition. The equipment must utilize a ground fault interrupt and/or be properly grounded.

F. Whenever the confined space is structured such that visual contact can not be maintained between entrants and the attendant, intrinsically-safe two-way radios must be utilized to maintain continuous contact between entrants and attendants.

G. All confined spaces must be isolated prior to entry.

H. Prior to opening or removing lids, covers, access doors, or hatches of a confined space, precautions must be taken to determine if it is safe to do so.

I. Whenever entering manholes or other confined spaces with permanent ladders, all rungs must be inspected to verify they are in safe and useable condition.

J. When working in a vertical confined space, precautions must be taken to prevent equipment and personnel from falling into the confined space opening. Tools should be lowered and removed from the space using a basket or sling to prevent falls and falling objects.

13. **POSTING AND RECORDKEEPING**

A. The Entry Permit(s), must be initially posted at the entrance to the confined space, and remain posted for the duration of the entry. **All permits must be weather protected to maintain integrity.**

B. The original, canceled Entry Permit(s) must be retained within the project file.

C. Copies of the canceled Confined Space Entry Permit(s) must be forwarded to the Divisional HSC and Corporate Safety Division for quality assurance checks and record retention.

- END OF PROCEDURE -

Executive Authorization: _____ **Date:** _____

ATTACHMENT D
UNDERGROUND/OVERHEAD UTILITIES CHECKLIST

UNDERGROUND/OVERHEAD UTILITY CHECKLIST

Project Name/Number_____ Date_____

Location_____

Prepared By_____ Project Manager_____

This checklist must be completed for any intrusive subsurface work such as excavation or drilling. It documents that overhead and underground utilities in the work are identified and located. The Project Manager shall request utility markouts before the start of field operations to allow the client and utility companies sufficient time to provide them. If complete information is not available, a magnetometer or other survey shall be performed to locate obstacles prior to intrusive subsurface activities.

Procedure

A diagram of the work area depicting the proposed location of intrusive subsurface work sites (i.e., boring locations, excavation locations) must be attached to this form. The diagram must clearly indicate the areas checked for underground structures/utilities, and overhead power lines. This form and the diagram must be signed by the BBL Project Manager (if present), the BBL Site Supervisor, and the client representative.

Checklist

Type of Structure	Present	Not Present	Method of Markout
Electric Power Line			
Natural Gas Line			
Telephone Line			
Water Line			
Product Line			
Sewer Line			
Steam Line			
Drain Line			
Underground Tank			
Underground Cable			
Overhead Power Line			
Overhead Product Line			
Other (Specify)			

Client Representative_____ Date_____

BBL Project Manager_____ Date_____

BBL Site Supervisor_____ Date_____

ATTACHMENT E
MATERIAL SAFETY DATA SHEETS

Genium Publishing Corporation
1145 Catalyn Street
Schenectady, NY 12303-1836 USA
(518) 377-8854

Material Safety Data Sheets Collection:

Sheet No. 713
Lead (Inorganic)

Issued: 8/90

Section 1. Material Identification

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Lead (Inorganic) (Pb) **Description:** Exists widely throughout the world in a number of ores. Its main commercial source is galena (lead sulphide). Lead mineral is separated from crude ores by blast-furnace smelting, drossing, or electrolytic refining. Lead is used mostly in manufacturing storage batteries. Other uses are in manufacturing tetraethyllead and both organic and inorganic lead compounds in ceramics, plastics, and electronic devices; in producing ammunition, solder, cable covering, sheet lead, and other metal products (brass, pipes, caulking); in metallurgy; in weights and as ballast; as a chemical intermediate for lead alkyls and pigments; as a constuction material for the tank linings, piping, and equipment used to handle the corrosive gases and liquids used in sulfuric acid manufacturing, petroleum refining, halogenation, sulfonation, extraction, and condensation; and for x-ray and atomic radiation protection.

R	0
I	4
S	-
K	0

Genium

HMIS
H 3
F 1
R 0
PPG*

Other Designations: CAS No. 7439-92-1, lead oxide; lead salts, inorganic; metallic lead; plumbum.
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*(TM) for a suppliers list.

Cautions: *Inorganic lead is a potent systemic poison.* Organic lead (for example, tetraethyl lead) has severe, but different, health effects. Occupational lead poisoning is due to inhalation of dust and fumes. Major affected organ systems are the nervous, blood, and reproductive systems, and kidneys. Health impairment or disease may result from a severe acute short- or long-term exposure.

* Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Lead (inorganic) fumes and dusts, as Pb, ca 100%

1989 OSHA PELs (Lead, inorganic compounds)
8-hr TWA: 50 µg/m³
Action Level TWA*: 30 µg/m³

29 CFR 1910.1025 Lead Standard
Blood Lead Level: 40 µg/100 g

1989-90 ACGIH TLV (Lead, inorganic, fumes and dusts)
TLV-TWA: 150 µg/m³

1988 NIOSH REL
10-hr TWA: <100 µg/m³

1985-86 Toxicity Data†
Human, inhalation, TC_{Lo}: 10 µg/m³ affects gastrointestinal tract and liver
Human, oral, TD_{Lo}: 450 mg/kg ingested over 6 yr affects peripheral and central nervous systems
Rat, oral, TD_{Lo}: 790 mg/kg affects multigeneration reproduction

* Action level applies to employee exposure without regard to respirator use.
† See NIOSH, *RTECS* (OF7525000), for additional mutative, reproductive, and toxicity data.

Section 3. Physical Data

Boiling Point: 3164 °F (1740 °C)
Melting Point: 621.3 °F (327.4 °C)
Vapor Pressure: 1.77 mm Hg at 1832 °F (1000 °C)
Viscosity: 3.2 cp at 621.3 °F (327.4 °C)
Appearance and Odor: Bluish-white, silvery, gray, very soft metal.

Molecular Weight: 207.20
Specific Gravity (20 °C/4 °C): 11.34
Water Solubility: Relatively insoluble in hot or cold water*

* Lead dissolves more easily at a low pH.

Section 4. Fire and Explosion Data

Flash Point: None reported	Autoignition Temperature: None reported	LEL: None reported	UEL: None reported

Extinguishing Media: Use dry chemical, carbon dioxide, water spray, or foam to extinguish fire.
Unusual Fire or Explosion Hazards: Flammable and moderately explosive in the form of dust when exposed to heat or flame.
Special Fire-fighting Procedures: Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective equipment. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Lead is stable at room temperature in closed containers under normal storage and handling conditions. It tarnishes on exposure to air. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Mixtures of hydrogen peroxide + trioxane explode on contact with lead. Lead is incompatible with sodium azide, zirconium, disodium acetylide, and oxidants. A violent reaction on ignition may occur with concentrated hydrogen peroxide, chlorine trifluoride, sodium acetylide (with powdered lead), ammonium nitrate (below 200 °C with powdered lead). Lead is attacked by pure water and weak organic acids in the presence of oxygen. Lead is resistant to tap water, hydrofluoric acid, brine, and solvents.
Conditions to Avoid: Rubber gloves containing lead may ignite in nitric acid.
Hazardous Products of Decomposition: Thermal oxidative decomposition of lead can produce highly toxic fumes of lead.

Section 6. Health Hazard Data

Carcinogenicity: Although the NTP and OSHA do not list lead as a carcinogen, the IARC lists it as probably carcinogenic to humans, but having (usually) no human evidence. However, the literature reports instances of lead-induced neoplasms, both benign and malignant, of the kidney and other organs in laboratory rodents. Excessive exposure to lead has resulted in neurologic disorders in infants. Experimental studies show lead has reproductive and teratogenic effects in laboratory animals. Human male and female reproductive effects are also documented.
Summary of Risks: Lead is a potent, systemic poison that affect a variety of organ systems, including the nervous system, kidneys, reproductive system, blood formation, and gastrointestinal (GI) system. The most important way lead enters the body is through inhalation, but it can also be ingested when lead dust or unwashed hands contaminate food, drink, or cigarettes. Much of ingested lead passes through feces without absorption into the body. Adults may absorb only 5 to 15% of ingested lead; children may absorb a much larger fraction. Once in the body, lead enters the bloodstream and circulates to various organs. Lead concentrates and remains in bone for many years. The amount of lead the body stores increases as exposure continues, with possibly cumulative effects. Depending on the dose entering the body, lead can be deadly within several days or affect health after many years. Very high doses can cause brain damage (encephalopathy).
Medical Conditions Aggravated by Exposure: Lead may aggravate nervous system disorders (e.g., epilepsy, neuropathies), kidney diseases, high blood pressure (hypertension), infertility, and anemia. Lead-induced anemia and its effect on blood presssure can aggravate cardiovascular disease.

Continue on next page

Section 6. Health Hazard Data, *continued*

Target Organs: Blood, central and peripheral nervous systems, kidneys, and gastrointestinal (GI) tract.
Primary Entry Routes: Inhalation, ingestion.
Acute Effects: An acute, short-term dose of lead could cause acute encephalopathy with seizures, coma, and death. However, short-term exposures of this magnitude are rare. Reversible kidney damage can occur from acute exposure, as well as anemia.
Chronic Effects: Symptoms of chronic long-term overexposure include appetite loss, nausea, metallic taste in the mouth, lead line on gingival (gum) tissue, constipation, anxiety, anemia, pallor of the face and the eye grounds, excessive tiredness, weakness, insomnia, headache, nervous irritability, fine tremors, numbness, muscle and joint pain, and colic accompanied by severe abdominal pain. Paralysis of wrist and, less often, ankle extensor muscles may occur after years of increased lead absorption. Kidney disease may also result from chronic overexposure, but few, if any, symptoms appear until severe kidney damage has occurred. Reproductive damage is characterized by decreased sex drive, impotence, and sterility in men; and decreased fertility, abnormal menstrual cycles, and miscarriages in women. Unborn children may suffer neurologic damage or developmental problems due to excessive lead exposure in pregnant women. Lead poisoning's severest result is encephalopathy manifested by severe headache, convulsions, coma, delirium, and possibly death.
FIRST AID
Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
Skin: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Consult a physician if any health complaints develop.
Inhalation: Remove exposed person to fresh air and support breathing as needed. Consult a physician.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If large amounts of lead were ingested, induce vomiting with Ipecac syrup. Consult a physician immediately.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Physician's Note: For diagnosis, obtain blood pressure, blood lead level (PbB), zinc protoporphyrin (ZPP), complete blood count for microcytic anemia and basophilic stippling, urinalysis, and blood urea nitrogen (BUN) of creatinine. Examine peripheral motor neuropathy, pallor, and gingival lead line. Use Ca-EDTA to treat poison, but *never* chelate prophylactically. Consult an occupational physician or toxicologist.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel and evacuate all unnecessary personnel immediately. Cleanup personnel should protect against inhalation of dusts or fume and contact with skin or eyes. Avoid creating dusty conditions. Water sprays may be used in large quantities to prevent the formation of dust. Cleanup methods such as vacuuming (with an appropriate filter) or wet mopping minimizes dust dispersion. Scoop the spilled material into closed containers for disposal or reclamation. Follow applicable OSHA regulations (29 CFR 1910.120).
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
EPA Designations
Listed as a RCRA Hazardous Waste (40 CFR 261.33, Appendix II—EP Toxicity Test Procedures)
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 1 lb (0.454 kg) [* per Clean Water Act, Sec. 307(a)]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)
OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).
Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact. Protective clothing made of man-made fibers and lacking turn-ups, pleats, or pockets retain less dust from lead.
Ventilation: Provide general and local ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.[107]
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially washing hands before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in tightly closed containers in a cool, dry, well-ventilated area away from all incompatible materials, direct sunlight, and heat and ignition sources.
Engineering Controls: Educate worker about lead's hazards. Follow and inform employees of the lead standard (29 CFR 1910.1025). Avoid inhalation of lead dust and fumes and ingestion of lead. Use only with appropriate personal protective gear and adequate ventilation. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Avoid creating dusty conditions. Segregate and launder contaminated clothing. Take precautions to protect laundry personnel. Practice good personal hygiene and housekeeping procedures. For a variety of reasons, the lead concentration in workroom air may not correlate with the blood lead levels in individuals.
Other Precautions: Provide preplacement and periodic medical examinations which emphasize blood, nervous system, gastrointestinal tract, and kidneys, including a complete blood count and urinalysis. Receive a complete history including previous surgeries and hospitalization, allergies, smoking history, alcohol consumption, proprietary drug intake, and occupational and nonoccupational lead exposure. Maintain records for medical surveillance, airborne exposure monitoring, employee complaints, and physician's written opinions for at least 40 years or duration of employment plus 20 years. Measurement of blood lead level (PbB) and zinc protoporphyrin (ZPP) are useful indicators of your body's lead absorption level. Maintain worker PbBs at or below 40 µg/100 g of whole blood. To minimize adverse reproductive health effects to parents and developing fetus, maintain the PbBs of workers intending to have children below 30 µg/100 g. Elevated PbBs increase your risk of disease, and the longer you have elevated PbBs, the greater your chance of substantial permanent damage.

Transportation Data (49 CFR 172.102)
IMO Shipping Name: Lead compounds, soluble, n.o.s.
IMO Hazard Class: 6.1
ID No.: UN2291
IMO Label: St. Andrews Cross (X, Stow away from foodstuffs)
IMDG Packaging Group: III

MSDS Collection References: 26, 38, 73, 84, 85, 88, 89, 90, 100, 101, 103, 109, 124, 126, 132, 133, 134, 136, 138, 139, 142, 143
Prepared by: MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Upfal, MD, MPH; **Edited by:** JR Stuart, MS

ATTACHMENT F
DAILY AIR MONITORING LOG

DAILY AIR MONITORING LOG

Project: Date:

Monitoring Instruments:

Air Monitor: Activity:

Level of Protection:

Time	Location	Instrument Reading	Comments

ATTACHMENT G
BBL DAILY SAFETY MEETING LOG

BBL DAILY SAFETY MEETING LOG

PROJECT: _____ LOCATION: _____

DATE/TIME: _____ ACTIVITY: _____

1. Work Summary
2. Physical/Chemical Hazards
3. Protective Equipment/Procedures
4. Emergency Procedures
5. Signatures of Attendees

ATTACHMENT H
ACCIDENT INVESTIGATION REPORT

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

ACCIDENT INVESTIGATION REPORT

Date of Report _____ Date of Accident _____ Time of Accident _____

Employee's Name _____ Title _____

Address _____ Employee # _____

City _____ State _____ Zip Code _____

Age _____ Sex _____ Marital Status _____

Date of Hire _____ Social Security # _____ # of Dependents _____

Description of Accident: _____

_____

_____

Description of Injuries: _____

_____

_____

Witnesses: _____

Injuries Required:

☐ First Aid (At Scene) ☐ Emergency Room Treatment ☐ Hospitalization

Location of Accident _____

First Aid Provided By _____

Medical Facility/Address _____

Attending Physician _____

Did Employee Return to Work?

☐ Yes ☐ No If Yes, Give Date _____

Did Employee Lose Time at Work?

☐ Yes ☐ No If Yes, Give Amount _____

Actions or Conditions Causing Accident: _____

_____

Corrective Actions: _____

_____

Further Comments: _____

_____

Employee Signature _____ Date _____

H&S Review _____ Date _____

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Appendix B

Air Monitoring Plan

Bern Metal/Universal Site
(Site No. 915135)
Buffalo, New York

September 1998

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

6723 Towpath Road, P.O. Box 66
Syracuse, New York, 13214-0066
(315) 446-9120

Air Monitoring Plan

1.0 AIR MONITORING PROGRAM

1.1 General

The purpose of the Air Monitoring Plan (AMP) is:

- to determine that the proper level of personnel protective equipment is used;
- to document that the level of worker protection is adequate;
- to assess the migration of contaminants to off-site receptors as a result of site work; and
- to assess whether site activities have resulted in any impact to the ambient air quality.

The remedial contractor shall supply all personnel, equipment, facilities, and supplies to develop and implement the air monitoring program described in this section. Depending on work activities and environmental conditions, equipment shall include at a minimum:

- an organic vapor analyzer (OVA); and
- real-time aerosol monitors.

The AMP includes both real-time and documentation air monitoring (personal and area sampling as needed). The purpose of real-time monitoring will be to determine if an upgrade (or downgrade) of PPE is required while performing on-site work and to implement engineering controls, protocols, or emergency procedures if site action levels are encountered.

BBL will also use documentation monitoring to ensure that adequate PPE is being used and to determine if engineering controls are mitigating the migration of contamination to off-site receptors. Documentation monitoring will include the collection and analysis of samples for total nuisance dust.

To protect the public in the residential neighborhood, the remedial contractor shall be responsible for suspending work and implementing engineering controls based upon detectable odors, as well as upon instrument monitoring results.

During the progress of active remedial work, the remedial contractor shall monitor the quality of the air in and around each active hazardous operation with real-time instrumentation prior to personnel entering these areas. Sampling at the hazardous work site will be conducted on a continuous basis. Any departures from general background will be reported to the Health and Safety Specialist (HSS) prior to entering the area. The HSS will determine when and if operations should be shut down.

Air monitoring shall be performed during intrusive activities (such as excavation) and loading for transportation of excavated materials by a minimum of one dedicated person with communication to the foreman. As discussed in Sections 1.3 and 1.4 of this plan, air monitoring (both real time and documentation monitoring) will be conducted using appropriate instrumentation at upwind locations to establish background levels daily, and/or as weather conditions warrant, and at downwind locations approximately halfway between the work zone and the site perimeter, if possible.

Air monitoring equipment will be operated by personnel trained in the use of the specific equipment provided and will be under the control of the HSS. A log of the location, time, type and value of each reading and/or sampling will be maintained. Copies of log sheets will be provided on a daily basis to the HSS.

1.2 Personnel Exposure Air Monitoring

1.2.1 Personnel Exposure Air Monitoring

Air monitoring will be conducted to evaluate airborne constituent levels. Personal exposure monitoring may be necessary to evaluate employee exposures. The monitoring results will dictate work procedures and the selection of PPE. The monitoring devices to be used, at a minimum, are a Miniram dust/total particulate meter and a photoionization detector (PID).

Monitoring for organic vapors for the purpose of estimating worker exposure level will be conducted in the breathing zone with the PID and Miniram during field activities. At a minimum, all readings will be recorded on an hourly basis on air monitoring logs (presented in Attachment F of the HASP) or in a field notebook.

Additionally, air monitoring will be conducted continuously with the LEL/O_2/H_2S/CO meter in areas where flammable vapors or gases are suspected or during excavation or confined space entry. All work activity must stop where tests indicate the concentration of flammable vapors exceeds 10 percent of the LEL at a location with a potential ignition source. Such an area must be ventilated to reduce the concentration to an acceptable level.

1.2.2 Noise Monitoring

Noise monitoring may be conducted as required. Hearing protection is mandatory for all employees in noise hazardous areas, such as around heavy equipment. As a general rule, sound levels that cause speech interference at normal conversation distance should require the use of hearing protection.

1.2.3 Personal Air Monitoring for Lead

To quantify the potential exposure of site personnel to lead in air during this project, a personal air sampling plan to determine airborne concentrations of lead will be implemented by each employer on site. The following paragraphs outline the frequency, sampling, analytical, and record-keeping requirements associated with personal air sampling during this project. The requirements of 29 CFR 1926.62 must also be met for lead.

Personal air sampling will be conducted at the initiation of a task or in the areas of the site where the site particulate action level is exceeded. Personal air samples for lead will be collected during two days of the first week a new task is initiated on the site (i.e., excavation, drilling, cap construction, etc.). Personal air samples for lead will be collected for at least 20% of the representative employees working in or around the site activities. Additional personal sampling may be required during on-site activities based on the results of the initial personal air monitoring assessment. Monitoring frequency for lead also will be based on the requirements of 29 CFR 1926.62.

Personal samples for lead will be collected according to NIOSH Method #7300 or equivalent. Samples will be collected utilizing a personal sample pump equipped with a mixed-cellulose ester filter. The sample pump must be calibrated prior to and following sample collection to a flow rate between 1.0 - 4.0 liters/minute with a representative sampler in place.

All personal samples will be submitted to an independent, American Industrial Hygiene Association-accredited laboratory for analysis. Accompanying media blanks also will be submitted to the laboratory for analysis at a rate of one blank for every five samples. Holding time requirements and field preparation procedures as specified in the respective NIOSH method will be followed.

1.2.4 Monitoring Equipment Maintenance and Calibration

All direct-reading instrumentation calibrations should be conducted under the approximate environmental conditions in which the instrument will be used. Instruments must be calibrated before and after use, noting the reading(s) and any adjustments which are necessary. All air monitoring equipment calibration, including the standard used for calibration, must be documented on a calibration log or in the field notebook. All completed documentation/forms must be reviewed by the HSS and maintained by the SS.

All air monitoring equipment will be maintained and calibrated in accordance with the specific manufacturers' procedures. Preventative maintenance and repairs will be conducted in accordance with the respective manufacturers' procedures. When applicable, only manufacturer-trained and/or authorized personnel will be allowed to perform instrument repairs or preventative maintenance.

If an instrument if found to be inoperative or suspected of giving erroneous readings, the HSS must be responsible for immediately removing the instrument from service and obtaining a replacement unit. If the instrument is essential for safe operation during a specific activity, that activity must cease until an appropriate replacement unit is obtained. The HSS will be responsible for ensuring a replacement unit is obtained and/or repairs are initiated on the defective equipment.

1.2.5 Action Levels

Table 1-1 presents airborne constituent action levels that will be used to determine the procedures and protective equipment necessary based on conditions as measured at the site.

1.3 Real-Time Perimeter Monitoring

Real-time organics and particulate monitoring will be conducted using the following equipment:

- A flame ionizing detector (FID) or a photo-ionization detector (PID) for Total Organic Vapors, such as The CENTURY OVA Total Organic Vapor Analyzer as manufactured by The Foxboro Company, or equal. The remedial contractor shall provide one FID/PID for each and every hazardous work zone operation, and one site backup FID/PID. Real-time organic monitoring will be conducted during any work in the hazardous work zone(s) and during the relocation of debris.

- A real-time aerosol monitor will be used to measure total particulates. The monitor shall be a MiniRam® Model MIEPDM-3, or equal. The instrument will be calibrated daily according to the procedure in the users manual. The meter shall be capable of measuring concentrations in the size range of less than 0.1 to 10 microns with a sensitivity down to 0.001 mg/m^3. Real-time particulate monitoring will be conducted during any excavation, transportation, or other handling of contaminated soil, scarification, and during the relocation of debris.

1.4 Action Levels

The following action levels will be established for work area and perimeter monitoring of organic vapors, odors and particulates. If the following levels are attained at half the distance between the work zone and the property line, then work will cease until engineering controls bring levels down to acceptable limits. These levels are

general and shall be used as minimum action levels. The remedial contractor shall develop site-specific perimeter monitoring action levels based on contaminants found in the work areas.

The action level for total organic vapors shall be five parts per million above background as measured on the FID. The action level for odors shall be noticeable odors.

Real-time monitoring will also be conducted at half the distance to the site perimeter including an upwind (background) and a downwind location. A background reading will be established daily at the beginning of the work shift. If the wind direction changes during the course of the day, a new background reading will be recorded. Downwind readings at half the distance to the site perimeter will be recorded when:

- site action levels have been exceeded at the work zone;
- if odors are evident;
- if complaints are received;
- during periods of higher activity; or
- at a minimum of twice per work shift.

Monitor the air, using the same equipment, for 10-15 minutes upwind of the work site to establish background level. The background level shall be established before the start of each shift every day.

Particulate levels should be integrated over a period not to exceed 15 minutes. In the event that downwind particulates are detected at levels in excess of 150 ug/m^3 or 2.5 times the established background level, whichever is less, at the work site, immediately re-measure the background concentrations upwind of the work zone also using the same equipment. If the measured particulate level at the work zone(s) is 100 ug/m^3 above the background level, monitor the downwind site perimeter and implement additional dust controls in the work zone(s). Continue to record hourly measurements of the upwind background concentrations, and compare such concentrations with the particulate level at the work zone(s), until the downwind level at the work zone is less than 100 ug/m^3 above the upwind level.

If at any time the measured particulate level at the work zone(s) is more than 150 ug/m^3, the REMEDIAL CONTRACTOR shall immediately suspend work at the remediation site, promptly notify the HSS, and implement suitable corrective action or engineering controls before work resumes.

If work activities generate any visible dust in off-site areas, the remedial contractor shall immediately notify the HSS, and implement suitable corrective action or engineering controls. This "no visible dust" requirement in off-site areas is in addition to the 100/150 ug/m^3 actions levels given above. The HSS shall have complete discretion in making this determination and the HSS's determination shall be final.

If site action levels are exceeded at half the distance to the site perimeter location for organic vapors, noticeable odors, or fugitive dust, work must be suspended and engineering controls must be implemented to bring concentrations back down to acceptable levels.

1.5 QA/QC Procedures

Appropriate QA/QC procedures will be implemented to ensure the validity of real-time monitoring. Appropriate procedures shall include:

- periodic instrument calibration;

- operator training;
- daily instrument performance checks; and
- details of the record keeping plan in QA/QC plans.

1.6 Documentation Monitoring

Documentation monitoring will be conducted at the site perimeter at four locations (north, south, east and west site perimeter) for total dust. Documentation monitoring will be conducted only during excavation, staging, grading, or decontamination activities.

A. Total nuisance dust will be collected using a PVC collection filter and personnel sampling pump and analyzed gravimetrically according to NIOSH Method 0500.

B. The perimeter locations will be established and marked with high visibility paint or flagging at approximately equidistant points around the site. Samples will be collected at a nominal height of 6 feet above ground surface (i.e., breathing zone).

C. Documentation samples will be collected continuously during excavation, staging, grading, and decontamination activities, during the normal work hours when activities are occurring on site. At the end of the week real-time monitoring data will be reviewed and the four samples from one day will be selected by the HSS and will be analyzed for lead.

1.7 Meteorological Monitoring System

A meteorological station will be installed on site that will be capable of recording, at a minimum, ambient temperature, windspeed, and wind direction. The remedial contractor shall install and operate the meteorological system in accordance with guidance established in NYSDEC Air Guide 19 - Oversight of Private Air Monitoring Networks, Revised June 1989; and Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV, Meteorological Measurements. EPA-600/4-82-060.

1.8 Reporting

The remedial contractor shall submit a written copy of real time air monitoring results to the HSS for each workday, by 10:00 a.m. the following workday, which shall include an appropriately scaled map of the work area depicting sample locations, wind direction and other pertinent meteorological data; date; time; analytical results; applicable standards and engineering controls implemented (if necessary).

1.9 Community Air Monitoring

Real-time air monitoring, for particulate levels at the perimeter of the work area is necessary:

A. Particulates shall be continuously monitored upwind, downwind and within the work area at temporary particulate monitoring stations. This requires a minimum of one monitor per station or work zone. If the downwind particulate level is 2.5 times background or 150 ug/m^3 greater than the upwind particulate level, then dust suppression techniques must be employed to reduce the particulates to below these levels. All readings must be recorded and be available for HSS's review.

As discussed above, the remedial contractor shall install a meteorological station on site that will be capable of recording, at a minimum, windspeed, ambient temperature, and wind direction.

1.10 Community Protection Plan

A. Community Protection Plan

The remedial contractor shall provide a Community Protection Plan (CPP). The CPP shall outline those steps to be implemented to protect the health and safety of surrounding human population and the environment.

B. Air Monitoring

As part of the Air Monitoring Program, use real-time monitoring and documentation sampling as described in the Subpart "Air Monitoring Program" of this section to determine if off-site emissions, as a result of the site work, poses a threat to the surrounding community.

Provide real-time air monitoring for particulate levels at the perimeter of the work area. Including the following:

1. Particulates shall be continuously monitored at the 4 documentation sampling stations for a total of 4 dust monitors. If the downwind particulate level is 150 ug/m^3 greater than the upwind particulate level, dust suppressing techniques shall be employed. All readings shall be recorded and be available for State (DEC & DOH) personnel to review.

Coordinate with local officials to arrange for notification and evacuation of the surrounding community in the event that off-site emissions pose a threat.

2. Off-Site Spill Response

Produce as part of the HASP a Spill Response Plan, also coordinated with local officials, in case of an off-site spill of either liquid or solid wastes. The plan shall include transportation routes and times, as well as the minimum requirements set forth in the Subpart titled "On-site Spill Containment Plan." The driver shall be supplied with Material Safety Data Sheets (MSDSs), a 24-hour emergency phone number, and instructions for reporting emergencies to local agencies and the project site.

TABLE 1-1
AIRBORNE CONSTITUENT ACTION LEVELS

Parameter	Reading	Action
Total Organic Vapors	0 ppm to ≤ 5 ppm	Normal operations; continue hourly breathing zone monitoring
	> 5 ppm to 25 ppm	Upgrade to Level C; increase monitoring frequency to every 15 minutes.
	≥ 25 ppm	Stop work; investigate cause of reading.
Airborne Particulate	0 to 0.150 mg/m^3	Normal operations
	> 0.150 mg/m^3	Initiate wetting of work area to control dust; upgrade to Level C and implement personal sampling for lead, if dust control measures do not control dust within 15 minutes.
Flammable Vapors (LEL)	< 10% LEL	Normal operations
	≥ 10% LEL	Stop work; evaluate area, ventilate area; investigate cause of reading.
Carbon Monoxide During Excavation or Confined Space Entry	0 ppm to 20 ppm	Normal operations, continue monitoring
	> 20 ppm	Stop work; evacuate area, ventilate area; investigate cause of reading.
Hydrogen Sulfide During Excavation or Confined Space Entry	0 ppm to 5 ppm	Normal operations, continue monitoring
	> 5 ppm	Stop work; evacuate area, ventilate area; investigate cause of reading.
Oxygen During Excavation or Confined Space Entry	19.5 % to 23.5%	Normal operations
	< 19.5% or > 23.5%	Stop work; evacuate area, ventilate area; investigate source of reading.

Notes:

1) Readings for TOV are for two consecutive minutes, at breathing zone height, measured with a calibrated photoionization detector.

2) Readings for particulate are for two consecutive minutes, at breathing zone height, measured with a calibrated Real Time Aerosol Monitoring (RAM). Dust sampling instruments provide "total dust" levels, and do not differentiate between contaminated and non-contaminated dust particulate. Dust action levels are based upon total dust and not respirable dust levels. Action levels are in excess of background levels, as measured either prior to activities on-site or off-site.

3) 150 ug/m^3 level based on NYSDEC Technical and Administrative Guidance Memorandum (TAGM) number 4031 "Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites".

Appendix C

Appendix C

Construction Quality Assurance/ Construction Quality Control Plan

Bern Metal/Universal Sites
(Site No. 915135)
Buffalo, New York

September 1998

BBL
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

30 Corporate Woods, Suite 160
Rochester, New York 14623-1477
(716) 292-6740

Table of Contents

1. Introduction

1.1 Purpose

The following Construction Quality Assurance/ Construction Quality Control (CQA/CQC) Plan has been developed to describe the materials and procedures necessary to ensure proper construction, evaluation, and documentation during implementation of the site remedy at the Bern Metal Site located in Buffalo, New York.

A multi-layered cap will be installed over an approximately 2.9 acre area of the Bern Metal Site as a component of the selected remedy specified in the March 1996, Record of Decision (ROD) issued by the New York State Department of Conservation (NYSDEC). In general, soils and other materials will be removed from identified areas and consolidated on-site under the cap. The selected remedy is described in the Remedial Design Work Plan prepared by Blasland, Bouck & Lee, Inc. dated January 1998. The proposed cap will consist of the following components (listed from surface to interface with consolidated relocated materials):

- A 6-inch thick layer of topsoil capable of sustaining native vegetation;
- A 12-inch thick soil protection layer;
- Geosynthetic Drainage Composite (GDC);
- 60 mil textured High Density Polyethylene (HDPE) liner; and
- 12 ounce per square yard (oz/yd^2) non-woven geotextile.

The remainder of this CQA/CQC Plan will described the requirements for each of these layers/materials including physical properties, installation, testing , and documentation.

1.2 Definition of Terms

The following terms and abbreviations are used throughout this CQA/CQC Plan. The definition of each term or abbreviation will be consistent throughout the text of this plan.

ASTM - American Society of Testing and Materials

CQA - Construction Quality Assurance

CQC - Construction Quality Control

Layer - A compacted stratum of soil composed of several lifts placed without deviation from design grade.

Lift - A constructed segment of soil layer placed at a maximum compacted thickness of 12 inches unless otherwise specified.

Project Consulting Engineer - The person or persons designated by the Owner or Owner's representative to provide CQA/CQC during the project. Duties delegated to the Project Consulting Engineer (PCE) shall include construction quality assurance sampling, testing, determination of limits of work, and measurement of work for payment and final acceptance.

1.3 Scope

Following the introductory section, Section 2.0 of this plan presents a description of the necessary personnel qualifications for the proper implementation of CQA/CQC procedures. Section 3.0 presents a discussion of the required CQA/CQC procedures for the construction of soil components of the cap. The CQA/CQC requirements associated with the installation of the geosynthetic portions of the cap are presented in Section 4.0.

2. Required Personnel Qualifications

2.1 CQA/CQC Management Organization

Bern Metal/Universal Iron & Metal Site Respondents will retain the services of a consulting engineering firm to serve as the PCE. The PCE must be licensed to practice services in the state of New York and will be responsible for observing, documenting, and certifying that activities associated with the construction of remediation components are in general conformance with construction plans and specifications.

The PCE will provide qualified CQA personnel to serve in the following capacities:

Project Director/Manager - The Project Director/Manager will serve as the official representative of the PCE and will have the ultimate technical and financial responsibility for the work performed. The Project Director/Manager will be responsible for overall coordination of CQA/CQC activities.

CQA Engineer - The CQA Engineer will report to the Project Director/Manager and will be responsible for coordination of observation, sampling, testing and documentation of construction activities on a daily basis.

CQA Observer - The CQA Observer will be on site on a daily basis and will document, sample and test under the direction of the CQA Project Director/Manager.

CQA/CQC Laboratory - The CQA/CQC Laboratory will be an independent, accredited materials testing laboratory who will be responsible for material testing as directed by the PCE and as required by this CQA/CQC Plan.

2.2 CQA Personnel Qualifications

In general, observation, sampling, testing, and/or documentation of construction materials and procedures shall be performed by a person or persons familiar with contemporary procedures and construction materials. The project personnel shall be under the direct supervision of a Professional Engineer licensed in the state of New York. Representatives of the PCE shall be familiar with the use of the equipment and methodology needed to sample and test soil. When necessary the PCE shall provide proof that CQA Observers have the appropriate training and/or certification for the use of testing equipment.

Specific qualifications for project personnel categories are as follows:

Project Director/Manager - The Project Director/Manager should be a professional engineer registered in the state of New York. The Project Director/Manager must demonstrate past experience in a position of significant responsibility for remediation/capping projects of similar magnitude and complexity in comparison with the project being undertaken. The Project Director/Manager must be knowledgeable of the project requirements and objectives, and must be familiar with the construction plans and technical specifications.

The Project Director/Manager will have the following responsibilities in the implementation of the procedures in the CQA/CQC Plan:

- Serve as the official representative of the PCE;
- Have ultimate responsibility for the implementation of the procedures in the CQA/CQC Plan;

- Ensure that appropriate technical review is completed by qualified representatives of the PCE for construction plans, technical specifications, any modifications to the plans and specifications and the construction certification report;
- Review and approve all design documentation, including the construction plans and technical specifications;
- Review and approve modifications to the construction plans and technical specifications as they occur during construction;
- Provide certification that the construction has been completed in general conformance with the plans and specifications in a construction certification report;
- Serve as the primary contact person for the PCE. Maintain contact with the Owner, Contractor and Subcontractors regarding conformance with the requirements in this plan;
- Provide overall coordination of the activities of the CQA Engineer and CQA Observer;
- Provide assistance to the CQA Engineer in the review of shop drawings and other submittals from contractors and subcontractors;
- Perform periodic site visits to review progress and CQA/CQC procedures;
- Determine acceptance of the installed portion of work to permit further construction;
- Ensure that the CQA Engineer and CQA Observer are notified of any noted deficiencies in quality control testing results or procedures so that corrective actions can be taken; and
- Review the weekly construction summary reports prior to submittal to the Owner.

CQA Engineer - The CQA Engineer must demonstrate a knowledge of remediation projects and applicable test methods through a combination of formal education, training and experience.

The CQA Engineer will have the following responsibilities in the implementation of the procedures in the CQA/CQC Plan:

- Oversee and coordinate CQA/CQC sampling and testing;
- Record any on-site activities that could result in damage to any earthwork or site improvements and report these activities to the Contractor and Project Director/Manager;
- Review daily construction reports with the CQA Observer;
- Prepare weekly project status reports;
- Serve as the daily contact person for the PCE. Maintain routine contact with the Owner and Contractor regarding conformance with quality control requirements;

- Review all shop drawings and other submittals from the Contractor for conformance with the technical specifications and take appropriate action after review;

- Review all field and laboratory CQA/CQC testing results for conformance with the technical specifications. Provide an interpretation of data to determine areas which are in conformance and in non-conformance with the technical specifications. Determine areas which require reworking and/or repair.

- Monitor delivery samples to the CQA/CQC Laboratory for testing;

- Coordinate activities of CQA Observer to establish proper sampling procedures;

- Perform regular site visits to review progress and CQA/CQC procedures; and

- Notify Contractor and CQA Observer of acceptance of installed portions of work.

CQA Observer - The CQA Observer must have a demonstrated knowledge of earthwork, construction documentation, and applicable material testing methods through a combination of formal education, training, and experience.

The CQA Observer will have the following responsibilities in the implementation of the procedures in the CQA/CQC Plan:

- Perform and document field and laboratory testing at the frequency established in this CQA/CQC Plan;

- Delineate areas of non-conformance based upon results of field and laboratory testing;

- Perform and document field sampling for CQA/CQC testing;

- Visually observe construction materials such as soil and geosynthetics delivered to the site to determine general conformance with material specifications;

- Observe and record procedures used for site preparation;

- Observe and record procedures used for construction activities;

- Assure delivery of samples to the CQA/CQC laboratory;

- Record any on-site activities that could result in damage to any component of the construction and report these activities to the Contractor and the CQA Project Director/Manager immediately as they are noted; and

- Prepare daily and weekly construction report.

2.3 Surveyors Qualifications

All surveys for the establishment of benchmarks and baselines necessary for construction, testing, and sampling, and for the collection of as-built information shall be carried out by persons practiced in land survey techniques and under the direction of a Professional Land Surveyor licensed in the state of New York.

2.4 Contractor Qualifications

The Contractor shall be trained and experienced in the construction of various remediation projects. The Contractor shall provide evidence of prior work on satisfactorily completed remediation projects of magnitude and complexity similar to the project in question. The Contractor shall also demonstrate that the field crew foreman has had prior experience on remediation projects and is familiar with the placement and preparation of soil layers, geosynthetics and other materials associated with the project.

2.5 Pre-Construction Meeting

Prior to the start of construction activity, a pre-construction meeting shall be held among representatives of the Owner, the PCE (including CQA personnel) and the Contractor. The topics covered at this meeting shall include, but may not be limited to the following activities:

- Discussing procedures and timing for providing each organization with all relevant CQA documents and supporting information;
- Familiarizing each organization with the site-specific CQA Report and its role relative to the design criteria, plans and specifications;
- Reviewing the responsibilities of each organization;
- Reviewing lines of authority and communication for each organization;
- Discussing the established procedures or protocol for construction, change orders, deficiencies, repairs and retesting;
- Reviewing methods of documenting and reporting inspection data;
- Reviewing methods for distributing and storing documents and reports;
- Reviewing work area security and safety protocol;
- Discussing procedures for the location and protection of construction materials, and for the prevention of damage of the materials from inclement weather or other adverse conditions;
- Conducting a site walk-around to review site conditions as well as staging and storage locations; and
- Discussing the Contractor's proposed construction plan, schedule and procedures.

The meeting will be documented by the PCE, and minutes will be transmitted to all parties.

3. Soil Component Construction

3.1 General

The cap for the Bern Metal Site will have two soil layers a soil protection layer and a topsoil layer. These soil layers will be constructed and tested in accordance with the procedures discussed in this section of the CQA/CQC Plan. Additional descriptions are provided in the materials and performance specifications (M&P Specifications) which have been included as part of the Pre-Final Design Report.

3.2 Required Materials

The cap of the Bern Metal Site will consist of a 60 mil textured HDPE geomembrane overlain by a Geosynthetic Drainage Composite (GDC), a 12-inch-thick (minimum) soil protection layer and a 6-inch-thick (minimum) topsoil layer. Geosynthetic components are discussed in Section 4.0, Geosynthetic Installation. The soil protection layer will be installed on top of the HDPE geomembrane to protect the underlying cap components from desiccation cracking, erosion, and root penetration. The topsoil layer will be installed on top of the protection layer to promote vegetative growth over the cap in order to prevent erosion, increase evapotranspiration of precipitation and enhance the appearance of the site.

3.2.1 Soil Protection Layer Material

The soil protection layer will be constructed with soil fill material (common fill). In general, the soil layer will contain no objects larger that 6 inches in greatest dimension . The soil protection layer shall also be free of any sharp objects or other deleterious substances that could potentially affect the GDC.

3.2.2 Topsoil Layer Material

The topsoil layer material shall be free from refuse, any material toxic to plant growth, woody vegetation, stumps, roots, clods of clay, stones, or any other object larger than 2 inches in greatest dimension. Sod and herbaceous growth such as grass and weeds do not have to be removed but should be mixed thoroughly into the soil during handling operations. The topsoil shall have a pH ranging between 5.0 and 7.5 and an organic content between 5 and 20 percent, as determined through laboratory testing of representative samples. Seeding to establish vegetation will occur as significant areas of the cover are completed to ensure the integrity of the cap and to prevent erosion of the topsoil layer.

3.3 Required Cover Installation Procedures

3.3.1 Soil Protection Layer Installation Procedures

The soil protection layer will be placed above the GDC. Although specific compaction requirements for the soil protection layer are not necessary, adequate compaction is expected and it may be advantageous to compact with a smooth drum roller at the end of each construction day to minimize erosion. Construction traffic directly on completed portions of the GDC will not be allowed during placement of the soil protection layer.

3.3.2 Topsoil Installation Procedures

The topsoil layer will be placed above the soil protection layer in a single, 6-inch-thick lift. Traffic on, and compaction of the topsoil layer should be kept to a minimum to ensure that it is properly aerated. If excessive compaction of the topsoil occurs in a given area, the area shall be diced and/or roto-tilled to reduce the in-place density of the topsoil layer to the satisfaction of the CQA Observer.

3.4 Testing and Evaluation of Cap Soil Components

The CQA/CQC testing and evaluation of the cap components will occur in two stages, pre-construction analysis and CQA/CQC testing during construction.

3.4.1 Pre-Construction Analysis

A pre-construction analysis of the material sources for the soil protection layer (soil fill material) and topsoil will be performed to determine if the proposed sources will be suitable for use during construction. If it is determined unsuitable other material sources will require analysis. Before any proposed source(s)has been evaluated, the Contractor will demonstrate that the proposed sources have a sufficient quantity of material available for construction.

3.4.1.1 Soil Protection Layer

The pre-construction analysis for the soil protection layer will consist of the performance of particle size analysis testing (ASTM D-422). The purpose of this testing will be to determine if the gradation characteristics of the soil are suitable for use as required in M&P Specification 02221 Soil Fill Material. CQA Observer will tour the proposed soil protection layer source and select representative 50-pound samples for particle size analysis.

3.4.1.2 Topsoil Analysis

The pre-construction analysis of the proposed topsoil source will consist of pH and percent organic determination performed on representative samples. Samples will be selected by the CQA Observer during a tour of the proposed source or stockpiles. The purpose of the testing will be to determine if the proposed material meets the requirements established in M&P Specification 02212 Topsoil ,Seeding and Mulch.

3.4.2 Testing During Construction

The types and frequency of CQA/CQC testing to be performed during construction of the soil components of the cap are presented in M&P Sections 02221 and 02212, for the soil protective layer and topsoil, respectively.

4. Geosynthetic Installation

4.1 General

Geosynthetic layers of the cap will be constructed and tested in accordance with the procedures discussed in this section of the CQA/CQC Plan.

4.2 Geotextiles

A non-woven geotextile layer will serve as a barrier between the relocated materials and the geomembrane.

4.2.1 Materials

The geotextile used will be non-woven and must meet the material criteria established in M&P Specification 02232 Geotextiles.

4.2.2 Required Installation Procedures

At a minimum, the Contractor will handle all geotextiles in such a manner to ensure they are not damaged in any way, and ensure compliance with the following:

- On slopes, the geotextiles will be securely anchored and rolled down the slope in such a manner as to continually keep the geotextile sheet in tension;
- In the presence of wind, all geotextiles will be weighted with sandbags or the equivalent. Such sandbags will be installed during placement and will remain until replaced with cap material;
- Geotextiles will be cut using an approved geotextile cutter only. If in place, special care must be taken to protect other materials from damage which could be caused by the cutting of the geotextiles;
- The Contractor will take any necessary precautions to prevent damage to underlying layers during placement of the geotextile;
- During placement of geotextiles, care will be taken not to entrap stones, excessive dust, or moisture that could damage the geotextile, generate clogging of drains or filters, or hamper subsequent seaming;
- All geotextile shall be sewn in accordance with the requirements of the M&P Specification; and
- A visual examination of the geotextile will be carried out over the entire surface, after installation, to ensure that no potentially harmful foreign objects such as pieces of sharp metal, are present.

4.2.3 Testing and Evaluation of Geotextiles

4.2.3.1 Pre-Construction Manufacturer Quality Assurance

Before installing any of the geosynthetic material, the following information must be provided by the Manufacturer.

- Origin and identification of the material used to manufacture the geosynthetic material;

- Copies of quality control certificates issued by the supplier of the material used to manufacture the geosynthetic material;

- Reports of tests conducted to verify the quality of the material used to manufacture the geosynthetics;

- A list of guaranteed "minimum average roll value" properties, as defined by ASTM, for the type of geotextile to be delivered. (The geotextile manufacturer will also provide the PCE with a written certification that the materials delivered have "minimum average roll values" which meet or exceed all property values guaranteed for that type of geotextile. The CQA Observer will examine all manufacturer certifications to ensure that the property values listed on the certifications meet or exceed those specified for the particular type of geotextile); and

- Identification of all rolls of geotextile with the following:

  - Manufacturer's name;
  - Product identification;
  - Lot number;
  - Roll number; and
  - Roll dimensions.

4.2.3.2 Shipment and Storage

During shipment and storage, the geotextile will be protected from ultraviolet light exposure, precipitation, mud, dirt, dust, puncture, or any other damaging or detrimental conditions. To that effect, geotextile rolls will be shipped and stored in relatively opaque and watertight wrappings.

Geotextiles will not be exposed to precipitation prior to being installed. Wrappings protecting geotextile rolls will be removed less than one hour prior to unrolling the geotextile. After the wrapping has been removed, a geotextile will not be exposed to sunlight for more than 15 days, unless otherwise specified and guaranteed by the geotextile manufacturer.

The CQA Observer will observe rolls upon delivery at the site and any deviation from the above requirements will be reported to the PCE. Any damaged rolls will be replaced by the Contractor.

4.2.3.3 Testing During Installation

Quality assurance testing will be performed in the field by the CQA Observer to assure conformity of the geosynthetic installation with the engineering plans, reports, and specifications. Upon installation of the rolls of geotextiles, the CQA Observer will inspect the material. Should the CQA Observer have any doubt regarding the specifications compliance of the geotextile on-site, samples will be removed and forwarded to the approved laboratory for testing to verify conformance to both the specifications and the list of guaranteed properties.

The following tests may be performed on geotextile samples:

- Mass per unit area;
- Tensile strength;
- Puncture strength; and
- Apparent opening size.

4.2.4 Geotextile Installation

Geotextiles shall be seamed using either a 12-inch overlap or by overlapping 3 inches and sewing. On slopes less than 10 percent the 12-inch overlaps may be utilized. Where the slope is greater than 10 percent, seaming shall be performed by overlap and sewing. No horizontal seams will be allowed on side slopes except as part of a patch. The Contractor will pay particular attention to seams to ensure that no earth cover material could be inadvertently inserted beneath the geotextile.

4.2.4.1 Repair

Any holes or tears in the geotextile will be repaired as follows:

1. On slopes: A patch made from the same geotextile will be double seamed into place with each seam ¼ inch to ¾ inch apart and no closer than one inch from any edge. Should any tear exceed 10 percent of the width of the roll, that roll will be removed from the slope and replaced; and

2. Non-slope: A patch made from the same geotextile will be spot-seamed in place with a minimum of 24-inch overlap in all directions.

Care will be taken to remove any soil or other material that may have penetrated the torn geotextile. The CQA Observer will observe any repair, note any non-compliance with the above requirements, and report them to the PCE.

4.3 Geomembrane Materials

Geosynthetic materials to be installed during the construction of the cap will also include a 60 mil textured HDPE geomembrane. All geosynthetic materials required will be provided and installed by the manufacturer or otherwise approved Contractor.

The work addressed under this section shall facilitate proper construction of all geosynthetic components of the cap. All work shall be constructed to the lines, grades, and dimensions indicated on the project plans, in accordance with project specifications, or as required by the PCE.

The CQA Observer shall issue a written daily report of activities. These reports shall include, as a minimum, observations and test results as well as problems encountered and solutions achieved. Construction reports summarizing significant events, as well as addressing all problems encountered and their solutions, shall be issued weekly to the Project Director/Manager. The format of these reports shall be established at the pre-construction meeting.

4.3.1 Geomembrane Manufacturing and Delivery

4.3.1.1 Raw Material

The raw material shall be first quality polyethylene resin containing no more than 2 percent clean recycled polymer by weight, and meeting the following specifications:

Specific Gravity (ASTM D792 Method A or ASTM D1505): $\geq$ 0.94

Melt Index (ASTM D1238 Condition 190/2.16): 0.1-1.1 g/10 min

Quality Control testing shall be carried out by the Manufacturer to demonstrate that the product meets this specification. Additional testing may be carried out for purposes of conformance by the CQA Laboratory. If the results of the manufacturer's and the CQA Laboratory's testing differ, the testing shall be repeated by the CQA Laboratory, and the manufacturer shall be allowed to monitor this testing. The results of this latter series of tests will prevail, provided that the applicable test methods have been followed.

Not more than one resin manufacturer shall be used in the production of at least 10 rolls delivered to the site.

Prior to the installation of any geomembrane material, the manufacturer shall provide the PCE with the following information:

- The origin (resin supplier's name, resin production plant), identification (brand name, number) and production date of the resin;
- A copy of the quality control certification issued by the resin supplier;
- Reports on the tests conducted by the manufacturer and/or the CQA Laboratory to verify the quality of the resin used to manufacture the geomembrane rolls assigned to the facility [these tests should include specific gravity (ASTM D792 Method A or ASTM D1505) and melt index (ASTM D1238 Condition 190/2.16]; and
- A statement that no reclaimed polymer is added in the resin (however, the use of polymer recycled during the manufacturing process may be permitted if done with appropriate cleanliness and if recycled polymer does not exceed 2% by weight).

The PCE shall review these documents and shall report any discrepancies with the above requirements to the Contractor.

4.3.1.2 Geomembrane Manufacturing

The Geomembrane Manufacturer shall provide the PCE with the following:

- A properties sheet for the material(s) proposed for use including minimum values for all specified properties measured using test methods indicated in the specifications, or equivalent;
- A list of quantities and descriptions of materials other than the base polymer which comprise the geomembrane;
- The sampling procedure and results of testing; and
- A certification that minimum property values given in the properties sheet are guaranteed by the Geomembrane Manufacturer.

The CQA Observer shall verify that:

- The property values certified by the Geomembrane Manufacturer meet all of the specifications; and

- The measurements of properties by the Geomembrane Manufacturer are properly documented and that the test methods used are acceptable.

In addition, the CQA Observer may undertake a manufacturing plant visit, preferably during the production of the particular geomembrane for this project, to evaluate the Manufacturer's quality control procedures.

4.3.1.3 Rolls

Prior to shipment, the Geomembrane Manufacturer shall provide the PCE with a quality control certificate for each roll of geomembrane provided. The quality control certificate shall be signed by a responsible party employed by the Geomembrane Manufacturer, such as the Production Manager. The quality control certificate shall include:

- Roll numbers and identification;

- Sampling procedures and results of quality control tests. At a minimum, results shall be given for thickness and thickness variation, tensile strength and elongation at yield and break, and trapezoidal tear resistance (both initial and residual), evaluated in accordance with the methods indicated in the specifications or equivalent methods approved by the PCE.

The PCE shall:

- Verify that the quality control certificates have been provided at the specified frequency for all rolls, and that each certificate identifies the rolls related to it; and

- Review the quality control certificates and verify that the certified roll properties meet the specifications.

4.3.1.4 Delivery

Transportation and Handling

Transportation of the geomembrane is the responsibility of the Geomembrane Manufacturer, or other party, as agreed upon. Shipping manifests and other documents will be as agreed upon at the pre-construction meeting. All handling on site is the responsibility of the Installer.

The CQA Engineer shall verify the following:

- Handling equipment used on the site is adequate and does not pose any risk of damage to the geomembrane; and

- The Installer's personnel handle the geomembrane with care.

Upon delivery at the site, the Installer and the CQA Engineer shall observe each roll for defects and for damage. This observation shall be conducted without moving the rolls unless defects or damages are found or suspected. The CQA Engineer shall indicate to the Project Director/Manager:

- Rolls, or portions thereof, which should be rejected and removed from the site because they have severe flaws; and

- Rolls which include minor repairable flaws.

Storage

The Installer shall be responsible for the storage of the geomembrane on site. The Owner shall provide storage space in a location (or several locations) such that on-site transportation and handling are minimized if possible. Storage space should be protected from theft, vandalism, passage of vehicles, etc.

The CQA Engineer shall verify that storage of the geomembrane ensures adequate protection against dirt, shock, and other sources of damage.

4.3.2 Geomembrane Installation

4.3.2.1 Subgrade Preparation

The Earthwork Contractor shall be responsible for preparing the relocated material according to the specifications.

The CQA Engineer shall verify that:

- A qualified land surveyor has verified all lines and grades:
- A qualified Geotechnical Engineer has verified that the relocated material meet the density specification and provides a firm, unyielding foundation;
- The surface to be lined has been rolled and compacted so as to be free of irregularities, sticks, roots, loose soil, and abrupt changes in grade;
- The surface of the relocated material does not contain rocks which may be damaging to the geomembrane; and
- There is no standing water or area excessively softened by high water content.

The Installer shall certify in writing that the surface on which the geomembrane will be installed is acceptable. The certificate of acceptance shall be given by the Installer to the Project Director/Manager prior to commencement of geomembrane installation in the area under consideration.

After the relocated material has been accepted by the Installer, it shall be the Installer's responsibility to indicate any change in the relocated material condition that may require repair work. If the CQA Engineer concurs with the Installer, then the Project Director/Manager shall ensure that the relocated material is repaired.

At any time before and during the geomembrane installation, the CQA Engineer shall indicate locations which may not provide adequate support to the geomembrane.

Special care shall be taken to avoid desiccation cracking or other damage to the relocated material layer. To that end:

- The CQA Engineer shall specify maximum allowable crack depth and width and should describe the procedure for repairing cracks;

- The Earthwork Contractor shall prepare a list of precautions to be taken against cracking and shall provide copies to the Project Director/Manager and the Geotechnical Engineer; and

- Immediately prior to the installation of the geomembrane liner, the relocated material layer surface shall be observed by the Installer and the CQA Observer.

4.3.2.2 Geomembrane Placement

Field Panel Identification and Placement

A field panel is a unit area of geomembrane which is to be seamed in the field (i.e., a field panel is a roll or a portion of roll cut in the field). It shall be the responsibility of the CQA Engineer to ensure that each field panel is given an "identification code" (number or letter-number) consistent with the layout plan. This identification code shall be agreed upon by the Project Director/Manager, Installer and CQA Engineer. This field panel identification code shall be as simple and logical as possible. The CQA Engineer shall establish a table or chart showing correspondence between roll numbers and field panel identification codes. The field panel identification code shall be used for all quality assurance records.

The CQA Engineer shall verify that field panels are installed at the location indicated in the Installer's layout plan, as approved or modified. The CQA Engineer shall evaluate every change in the schedule proposed by the Installer and advise the Project Director/Manager on the acceptability of that change. The CQA Engineer shall verify that the condition of the relocated material has not changed detrimentally during installation. The CQA Engineer shall record the identification code, location and date of installation of each field panel.

Geomembrane placement shall not proceed at an ambient temperature below 32°F (0°C) unless a means to raise the temperature above 32°F is developed by the installer and approved by the owner and the CQA Engineer. Geomembrane placement shall not be done during any precipitation, in the presence of excessive moisture (e.g., fog, dew), in an area of ponded water, or in the presence of hazard causing winds.

The CQA Engineer shall verify that the above conditions are fulfilled. The CQA Engineer shall also verify the following:

- Any equipment used does not damage the geomembrane by handling, trafficking, excessive heat, leakage of hydrocarbons or other means;

- The prepared surface underlying the geomembrane has not deteriorated since previous acceptance, and is still acceptable immediately prior to geomembrane placement;

- Any geosynthetic elements immediately underlying the geomembrane are clean and free of debris;

- All personnel working on the geomembrane do not smoke, wear damaging shoes, or engage in other activities which could damage the geomembrane;

- The method used to unroll the panels does not cause scratches or crimps in the geomembrane and does not damage the supporting soil;

- The method used to place the panels minimizes wrinkles (especially differential wrinkles between adjacent panels);

- Adequate slackness is provided to allow for thermal contraction and nowhere is the geomembrane taut or bridging voids, changes in grades, or depressions;

- Adequate temporary loading and/or anchoring (e.g., sand bags, ties), not likely to damage the geomembrane, have been placed to prevent uplift by wind; and

- Direct contact with the geomembrane is minimized, i.e, the geomembrane is protected by geotextile, extra geomembrane, or other suitable materials, in areas where excessive traffic may be expected.

Damage

The CQA Engineer shall inspect each panel after placement and prior to seaming, for damage. The Geosynthetic Quality Assurance Manager shall advise the Project Director/Manager which panels, or portions of panels, should be rejected, repaired, or accepted. Damaged panels or portions of damaged panels which have been rejected shall be marked.

4.3.2.3 Field Seaming

Seam Layout

The Installer shall provide the Project Director/Manager and the CQA Engineer with a seam layout drawing. The CQA Engineer shall review the seam layout drawing and verify that it is consistent with accepted state of practice. No panels may be seamed in the field without the CQA Engineer's approval. No panels not specifically shown on the seam layout drawing may be used without the CQA Engineer's prior approval.

In general, seams should be oriented parallel to the line of maximum slope (i.e., oriented along, not across the slope). In corners and odd-shaped geometric locations, the number of seams should be minimized. Horizontal seams should be located at least 5 feet from the toe of the slope, or firm areas of potential stress concentrations, unless otherwise authorized.

A seam numbering system compatible with the panel numbering system shall be agreed upon at the pre-construction meeting.

Extrusion Process

The extrusion-welding apparatus shall be equipped with gauges giving the temperature in the apparatus and at the nozzle.

The Installer shall provide documentation regarding the extrude to the Project Director/Manager and the CQA Engineer, and shall certify that the extrude is compatible with the specifications and is comprised of the same resin as the geomembrane sheeting.

The CQA Engineer shall log apparatus temperatures, extrude temperatures, ambient temperatures, and geomembrane surface temperatures at appropriate intervals.

The CQA Engineer shall verify that:

- The Installer maintains on-site the number of spare operable seaming apparatus decided at the Pre-construction Meeting;
- The extruder is purged prior to beginning a seam until all heat-degraded extrude has been removed from the barrel;
- The electric generator is placed on a smooth base such that no damage occurs to the geomembrane;
- Grinding is performed perpendicular to the seam in as far as possible and is completed no more than two hours prior to seaming;
- Excessive gouge depth does not result from grinding;
- A smooth insulating plate or fabric is placed beneath the hot welding apparatus after usage; and
- The geomembrane is protected from damage in heavily trafficked areas.

Fusion Process

The fusion-welding apparatus must be an automated vehicular-mounted device. The fusion-welding apparatus shall be equipped with gauges giving the applicable temperature and pressures. The CQA Engineer shall log ambient, seaming apparatus, and geomembrane surface temperatures as well as seaming apparatus pressures.

The CQA Engineer shall also verify that:

- The Installer maintains on-site the number of spare operable seaming apparatus decided at the Pre-construction Meeting;
- The electric generator is placed on a smooth base such that no damage occurs to the geomembrane;
- For cross seams, the edge of the cross seam is ground to a smooth incline (top and bottom) prior to welding;
- A smooth insulating plate or fabric is placed beneath the top welding apparatus after usage;
- The geomembrane is protected from damage in heavily trafficked areas; and
- A movable protective layer is used as necessary directly below each overlap of geomembrane that is to be seamed to prevent buildup of moisture between the sheets.

Seam Preparation

The CQA Engineer shall verify that:

- Prior to seaming, the seam area is clean and free of moisture, dust, debris of any kind, and foreign material;
- If seam overlap grinding is required, the process is completed according to the Geomembrane Manufacturer's instructions within one hour of the seaming operation, and in a way that does not damage the geomembrane; and
- Seams are aligned with the fewest possible number of wrinkles and "fishmouths".

Weather Conditions for Seaming

Unless authorized in writing by the Project Director/Manager, no seaming shall be attempted at an ambient temperature below 32°F (0°C) or above 104°F (40°C). The CQA Engineer shall verify that these weather conditions are fulfilled and will advise the Project Director/Manager and CQA Observer if they are not. The Project Director/Manager shall then decide if the installation shall be stopped or postponed.

Overlapping and Temporary Bonding

The CQA Engineer shall verify that:

- The panels of geomembrane have a finished overlap of a minimum of 3 inches for extrusion welding and 5 inches for fusion welding, but in any event, sufficient overlap shall be provided to allow peel tests to be performed on the seam; and
- The procedure used to temporarily bond adjacent panels together does not damage the geomembrane.

Trial Seams

Trial seams shall be made on fragments of geomembrane liner to verify that seaming conditions are adequate. Such trial seams shall be made at the beginning of each seaming period for each seaming apparatus used that day. Also, each seamer shall make at least one trial seam every four hours. Trial seams shall be made under the same conditions as actual seams. The trial seam sample shall be at least 3 feet long by 1 foot wide (after seaming) with the seam centered lengthwise. Seams will have an overlap beyond the weld large enough to perform destructive peel tests, but not exceed 5 inches. The CQA Engineer shall observe all trial seam procedures. At the CQA Engineer's discretion, samples of trial seams may be cut for field and/or laboratory testing.

General Seaming Procedure

Unless otherwise specified, the general seaming procedure used by the Installer shall be as follows:

- For fusion welding, a movable protective layer of plastic may be required to be placed directly below each overlap of geomembrane that is to be seamed. This is to prevent any moisture buildup between the sheets to be welded;
- If required, a firm substrate shall be provided by using a flat board, a conveyor belt, or similar hard surface directly under the seam overlap to achieve proper support;

- Fishmouths or wrinkles at the seam overlaps shall be cut along the ridge of the wrinkles in order to achieve a flat overlap. The cut fishmouths or wrinkles shall be seamed and any portion where the overlap is inadequate shall then be patched with an oval or round patch at the same geomembrane extending a minimum of 6 inches (150 mm) beyond the cut in all directions;

- If seaming operations are carried out at night, adequate illumination shall be provided: and

- Seaming shall extend to the outside edge of panels to be placed in the anchor trench.

The CQA Engineer shall verify that the above seaming procedures are followed, and shall inform the Project Director/Manager and the CQA Observer if they are not.

4.3.2.4 Seam Continuity Testing

Non-Destructive Testing

The Installer shall nondestructively test all field seams over their full length using a vacuum test unit, air pressure test (for double fusion seams only), or other approved method. The purpose of nondestructive tests is to check the continuity of seams. It does not provide any information on seam strength. Continuity testing shall be carried out as the seaming work progresses, not at the completion of all field seaming.

The CQA Engineer shall:

- Observe all continuity testing;

- Record location, date, test unit number, name of tester, and outcome of all testing; and

- Inform the Installer and CQA Observer of any required repairs.

The Installer shall complete any required repairs in accordance with Section 4.6.2.5.

The following procedures shall apply to locations where seams cannot be nondestructively tested in their final configuration:

- If the seam is accessible to testing equipment prior to final installation, the seam shall be nondestructively tested prior to final installation; and

- If the seam cannot be tested prior to final installation, the seam shall be cap-stripped and all operations shall be observed by the CQA Engineer for uniformity and completeness. Alternatively, the Project Director/Manager may direct the CQA Engineer to arrange for a leak survey of the final installation (e.g., sumps, etc.).

The seam number, date of observations, name of tester, and outcome of the test shall be recorded by the CQA Engineer.

i. Vacuum Testing

The equipment shall be comprised of the following:

- An approved vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft neoprene gasket attached to the bottom, port hole or valve assembly, and a vacuum gauge;
- A steel vacuum tank and pump assembly equipped with a pressure controller and pipe connections;
- A rubber pressure/vacuum hose with fittings and connections;
- A bucket and wide paint brush; and
- A soap solution.

The following procedures shall be followed:

- Energize the vacuum pump and reduce the tank pressure to approximately 5 psi (10 in. of Hg.) (35 kPa) gauge;
- Wet a strip of geomembrane approximately 12 in. by 48 in. with the soapy solution;
- Place the box over the wetted area;
- Close the bleed valve and open the vacuum valve;
- Ensure that a leak tight seal is created;
- For a period of not less than 15 seconds, examine the geomembrane through the viewing window for the presence of soap bubbles;
- If no bubbles appear after 15 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3 inches overlap, and repeat the process; and
- All areas where soap bubbles appear shall be marked and repaired in accordance with technical specifications.

ii. Air Pressure Testing

The following procedures are applicable to those processes which produce a double seam with an enclosed space.

The equipment shall be comprised of the following:

- An air pump (manual or motor driven) equipped with a pressure gauge capable of generating and sustaining a pressure between 25 and 30 psi (160 and 200 Kpa) and mounted on a cushion to protect the geomembrane;
- A rubber hose with fittings and connections; and
- A sharp hollow needle, or other approved pressure feed device.

The following procedures shall be followed:

- Seal both ends of the seam to be tested:

- Insert needle or other approved pressure feed device into the tunnel created by the fusion weld;
- Insert a protective cushion between the air pump and the geomembrane;
- Energize the air pump to a pressure between 25 and 30 psi (160 and 200 Kpa), close valve, and sustain pressure for approximately 5 minutes;
- If loss of pressure exceeds 3 psi or does not stabilize, locate faulty area and repair in accordance with technical specifications; and
- Remove needle or other approved pressure feed device and seal.

Destructive Testing

Destructive seam tests shall be performed at selected locations. The purpose of these tests is to evaluate seam strength. Seam strength testing shall be done as the seaming work progresses, not at the completion of all field seaming.

i. Location and Frequency

The CQA Engineer shall select locations where seam samples will be cut out for laboratory testing. Those locations shall be established as follows:

- A minimum frequency of one test location per 500 feet of seam length;
- A maximum frequency is unspecified but shall be at the discretion of the Project Director/Manager; and
- Test locations shall be determined during seaming at the CQA Engineer's discretion. Selection of such locations may be prompted by suspicion of excess crystallinity, contamination, offset welds, or any other potential cause of imperfect welding.

The Installer shall not be informed in advance of the locations where the seam samples will be taken.

ii. Sampling Procedures

Samples shall be cut by the Installer as the seaming progresses in order to have laboratory test results before the geomembrane is covered by another material.

The CQA Engineer shall:

- Observe the sample cutting;
- Assign a number to each sample, and mark it accordingly;
- Record the sample location on the layout drawing; and
- Record the reason for taking the sample at this location (e.g., statistical routine, suspicious feature of the geomembrane).

All holes in the geomembrane resulting from destructive seam sampling shall be immediately repaired in accordance with repair procedures described in Section 4.6.2.5. The continuity of the new seams in the repaired area shall be tested according to Section 4.6.2 (Non-Destructive Testing).

iii. Size of Samples

At a given sampling location, two types of samples shall be taken by the Installer. First, two samples for field testing should be taken. Each of these samples shall be 1 inch wide and 12 inches long, with the seam centered parallel to the width. The distance between these two samples shall be 54 inches. If both samples pass the field test described in Paragraph iv, a sample for laboratory testing shall be taken.

The sample for laboratory testing shall be located between the two samples for field testing. The sample for laboratory testing shall be 12 inches wide by 54 inches long with the seam centered lengthwise. The sample shall be cut into three parts and distributed as follows:

- One portion to the Installer for laboratory testing, 12 inches x 18 inches;
- One portion to the CQA Laboratory for testing, 12 inches x 18 inches; and
- One portion to the Owner for archive storage, 12 inches x 18 inches.

iv. Field Testing

The two 1 inch wide strips mentioned in Paragraph iii shall be tested in the field, or tensiometer, for peel and shear respectively and shall not fail in the seam. Only ductile failures will be accepted, regardless of where they occur.

The CQA Engineer shall witness all field tests and mark all samples and portions with their number. The CQA Engineer shall also log the date and time, ambient temperature, number of seaming unit, name of seamer, welding apparatus temperatures and pressures, and pass or fail description, and attach a copy to each sample portion.

v. CQA Laboratory Testing

Destructive test samples shall be packaged and shipped, if necessary, under the responsibility of the CQA Engineer in a manner which will not damage the test sample. The CQA Observer will verify that packaging and shipping conditions are acceptable. The Project Director/Manager will be responsible for storing the archive samples. Test samples shall be tested by the CQA Laboratory.

Testing shall include "Seam Strength and Peel Adhesion" [ASTM D638 with type M-1 specimen, 1 inch wide, tested at 2 inches per minute]. These terms are defined in the specifications. The minimum acceptable values to be obtained in these tests are those indicated in these specifications. At least five specimens shall be tested for each test method. Specimens shall be selected alternately by test from the samples (i.e., peel, shear, peel, shear...). For double wedge welds, both inner and outer seam shall be tested and found to be acceptable.

The CQA Laboratory shall provide test results no more than 24 hours after they receive the samples. The CQA Engineer shall review laboratory tests results as soon as they become available, and make appropriate recommendations to the Project Director/Manager.

vi. Procedures for Destructive Test Failure

The following procedures shall apply whenever a sample fails a destructive test, whether that test is conducted by the CQA Laboratory, the Installer's laboratory, or by field method. The Installer has two options:

- The Installer can reconstruct the seam between any two passed test locations; and
- The Installer can trace the welding path to an intermediate location at least 10 feet from the point of the failed test in each direction and take a small sample for an additional field test. If these additional samples pass the test, then full laboratory samples are taken. If these samples pass the laboratory tests, then the seam is reconstructed between these locations. If either sample fails, then the process is repeated to establish the zone in which the seam should be reconstructed.

All acceptable seams must be bounded by two locations from which samples passing laboratory destructive tests have been taken. The CQA Engineer shall document all actions taken in conjunction with destructive test failures.

4.3.2.5 Defects and Repairs

Identification

All seams and non-seam areas of the geomembrane shall be examined by the CQA Engineer for identification of defects, blisters, undispersed raw materials and any signs of contamination by foreign matter. Because light reflected by the geomembrane helps to detect defects, the surface of the geomembrane shall be clean at the time of examination. The geomembrane surface shall be broomed or washed by the Installer if the amount of dust of mud inhibits examination.

Evaluation

Each suspect location both in seam and non-seam areas shall be non-destructively tested using the methods described in Section 4.6.2.4 as appropriate. Each location which fails the non-destructive testing shall be marked by the CQA Engineer and repaired by the Installer. Work shall not proceed with any materials which will cover locations which have been repaired until laboratory tests with passing results are available.

Repair Procedures

Any portion of the geomembrane exhibiting a flaw, or failing a destructive or nondestructive test, shall be repaired. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be agreed upon between the Installer, the CQA Engineer and Project Manager/Engineer. The procedures available include:

- Patching, used to repair large holes, tears, undispersed raw materials, and contamination by foreign matter;
- Spot welding or seaming, used to repair small tears, pinholes, or other minor, localized flaws;
- Capping, used to repair large lengths of failed seams;
- Topping, used to repair areas of inadequate seams, which have an exposed edge; and

- Removing bad seam and replacing with a strip of new material welded into place (used with large lengths of fusion stems).

In addition, the following provisions shall be satisfied:

- Surfaces of the geomembrane which are to be repaired using the extrusion process shall be abraded perpendicular to the seam and no more than one hour prior to the repair;
- All surfaces must be clean and dry at the time of the repair;
- No rewelding of extruded seams will be allowed:
- All seaming equipment used in repairing procedures must be approved:
- The repair procedures, materials, and techniques shall be approved in advance of the specific repair by the CQA Engineer and Installer;
- Patches or caps shall extend at least 6 inches beyond the edge of the defect, and all corners of patches shall be rounded with a radius of at least 3 inches; and
- The geomembrane below large caps should be appropriately cut to avoid water or gas collection between the two sheets.

Verification of Repairs

Each repair shall be numbered and logged. Each repair shall be non-destructively tested using the methods described in Section 4.6.2.4 as appropriate. Repairs which pass the non-destructive test shall be taken as an indication of an adequate repair. Large caps may be of sufficient extent to require destructive test sampling, at the discretion of the CQA Engineer. Failed tests indicate that the repair shall be redone and retested until a passing test results. The CQA Engineer shall observe all repair and all non-destructive testing of repairs, note on the geomembrane that is has been repaired, and document each repair thoroughly.

Large Wrinkles

When seaming of the secondary geomembrane lines is completed (or when seaming of a large area of the secondary geomembrane lines is complete) and prior to placing overlying materials, the CQA Engineer shall observe the geomembrane wrinkles. The CQA Engineer shall indicate to the Project Director/Manager and the CQA Observer which wrinkles should be cut and reseamed by the Installer. The seam thus produced shall be tested like any other seam. The same process will be repeated for primary geomembrane liner.

4.3.2.6 Lining System Acceptance

The Installer and the Manufacturer shall retain all ownership and responsibility for the geosynthetics in the lining system until acceptance by the Owner.

The geosynthetic lining system shall be accepted by the Owner when:

- The installation is finished:
- Verification of the adequacy of all seams and repair, including associated testing, is complete;
- All documentation of installation is complete including the CQA Engineer's final report;
- Certification reports, including "as built" drawing(s), sealed by registered professional engineers have been received by the Project Director/Manager; and
- The Post-Construction Resolution Meeting has been held and all follow-up required by the Owner is complete.

The CQA Engineer shall certify that installation has proceeded in accordance with the Geosynthetic section of the Quality Assurance/Quality Control Plan.

4.3.2.7 Materials in Contact with the Geomembrane

Soils

The CQA Engineer shall verify that the specifications are consistent with the state of the art such as:

- A geotextile or other cushion approved by the designer may be installed between angular aggregate and the geomembrane;
- Equipment used for placing soil shall not be driven directly on the geomembrane;
- A minimum thickness of 1 foot of soil is specified between a light dozer (such as a wide pad Caterpillar D-3 or lighter) and the geomembrane;
- A minimum thickness of 3 feet of soil is specified between rubber-tired vehicles and the geomembrane; and
- In heavily trafficked area such as access ramps, soil thickness should be at least 3 feet.

The CQA Engineer shall:

- Measure soil thickness and verify that the required thicknesses are present (or, if applicable, verify that required measurements have been completed by the Geotechnical Engineer, if any; and
- Verify that placement of soil is done in such a manner that geomembrane damage is unlikely.

The CQA Engineer shall inform the Project Director/Manager if the above conditions are not fulfilled.

Appurtances

The CQA Engineer shall review the specifications and verify the use of geosynthetic layers between structures and geomembranes.

The CQA Engineer shall verify that;

- Installation of the geomembrane in appurtenance areas, and connection of geomembrane to appurtenances have been made according to specification;
- Extreme care is taken while welding around appurtenances since neither non-destructive nor destructive testing may be feasible in these area; and
- The geomembrane has not been visibly damaged while making connections to appurtenances.

The CQA Engineer shall inform the Project Director/Manager if the above conditions are not fulfilled.

4.4 Geosynthetic Drainage Composite

A geosynthetic drainage composite (GDC) will be installed during side slope liner construction.

4.4.1 Geosynthetic Drainage Composite Manufacturing and Directory

The GDC manufacturer shall provide the CQA Engineer with a list of guaranteed properties for the type of GDC to be supplied. The GDC manufacturer shall provide CQA Observer with a written certification signed by an officer of the Quality Control Manager that the GDC's actually delivered have properties that meet or exceed the guaranteed properties.

The Contractor shall examine all manufacturer's certifications to ensure that the property values listed on the certifications meet or exceed those specified.

4.4.2 Labeling

The GDC manufacturer shall identify all rolls of GDC's with the following:

- Manufacturer's name;
- Product identification;
- Lot number;
- Roll number; and
- Roll dimensions.

CQA Engineer shall examine each roll upon delivery and any deviation from the above requirements shall be reported to the Contractor.

4.4.3 Shipment and Storage

GDC cleanliness is essential to its performance and GDC rolls should be wrapped in polyethylene sheets or otherwise protected against dust and dirt during shipping and storage. The wrapping should be removed less than one hour before placement. CQA Engineer shall verify that GDC's are free of dirt and dust immediately prior to installation. If the GDC's are judged dirty or dusty, washing shall be observed by the CQA Engineer and improper washing operations shall be reported to the Contractor.

4.4.4 Conformance Testing

4.4.4.1 Tests

All GDC Testing will be done in accordance with Section MP-02219 of the M&P Specifications.

4.4.4.2 Sample Procedures

Samples shall be taken across the entire width of the roll and not include the first outer wrap. Unless otherwise specified, samples shall be 3 feet long by the roll width. CQA Engineer shall mark the machine direction on the samples with an arrow.

Unless otherwise specified, samples shall be taken at a rate of one per lot or one per 100,000 square feet, whichever is the greater frequency.

4.4.4.3 Test Results

CQA Engineer shall examine all results from laboratory conformance testing and shall report any non-conformance to the Contractor.

4.4.4.4 Handling and Placement

Materials handling and placement shall be as specified in Section MP-02219 of the M&P Specifications.

4.4.5 Installation

Installation shall be as stated in Section MP-02219 of the M&P Specifications.

4.4.6 Repairs

Repairs shall be made in accordance with Section MP-02219 of the M&P Specifications.

Appendix D

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

Appendix D

TECHNICAL REPORT

Pre-Design Investigations

Bern Metal/Universal Sites
(Site No. 915135)
Buffalo, New York

September 1998

BBL
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Pre-Design Investigations

1.0 INTRODUCTION

This report presents a summary of the field activities and analytical results of the soils investigation performed by BBL at the Bern Metal/Universal Sites, and adjacent off-site properties (i.e., Laub Warehouse and Conrail). The soils investigation was performed in accordance with the New York State Department of Environmental Conservation (NYSDEC)-approved "Field Sampling Plan, Bern Metal/Universal Site (Site No. 915135), Buffalo, New York" (BBL, January 1998) and the following supporting documents:

- Sampling and Analysis Plan (SAP) and a Quality Assurance Project Plan (QAPP), approved by the NYSDEC, as part of the "Work Plan, Remedial Investigation/Feasibility Study for the Bern Metal/Universal Site, October 1993" (RI/FS Work Plan) prepared by ERM-Northeast (ERM-Northeast) prepared for the Bern Metal/Universal Site RI/FS; and

- Site Health and Safety Plan (HASP) prepared by BBL in January 1998.

1.1 Report Organization

This report has been prepared to describe the field activities and analytical results of the soils investigation. Section 2 discusses the field investigation activities and Section 3 discusses the analytical results.

2.0 FIELD ACTIVITIES

The field activities performed as part of the soils investigation include the following:

Task 1 - Clearing and Grubbing;
Task 2 - Location of Sample Points; and
Task 3 - Soil Sampling.

The field activities were initiated on April 3, 1998 and completed on April 16, 1998.

2.1 Clearing and Grubbing

Clearing and grubbing was performed on April 3, 1998, within the Conrail Right-of-Way (ROW) property located immediately west of the Universal Metals property. The clearing and grubbing, performed by Maxim Technologies, Inc. (Maxim) of Hamburg, New York, involved the cutting down of trees and shrubs within this property to allow for surveyors to establish soil boring locations and drill rig access to the soil boring locations. The trees and shrubs were placed adjacent to the fence separating the Conrail ROW and Universal Metals property.

2.2 Location of Sample Points

This field task was performed by Wendel of Lockport, New York. Baselines were established in each sampling area to develop the grid layout for each investigation area. The sampling locations were then taped off from the survey baselines and existing site control (i.e. building corners, fence corners, etc.) to establish the soil boring locations. The survey included the location of 121 soil boring locations and four Conrail drainage ditch sampling locations, as shown on Figure D-1.

2.3 Soil Sampling

Surface and subsurface soil samples were collected using two-inch diameter split-spoon samplers or two-inch diameter geoprobe soil samplers advanced by a drill rig. The auger flight(s) and/or split-spoon samplers were decontaminated between soil boring locations and sample collection intervals as referenced in the Bern Metal/Universal Sites QAPP. In addition, selected soil samples on the Universal property were collected from test pits advanced by a backhoe due to the presence of additional fill material imported to the property.

Characterization Area	No. Of Soil Boring/Sampling Locations	Number of Samples Collected	Number of Samples Analyzed	Sample Types
Universal Metals	34	117	79	Surface and Subsurface
Conrail Right-of-Way	43	229	53	Surface and Subsurface
Conrail South	25	119	43	Surface and Subsurface
Laub Property	19	78	28	Surface and Subsurface
Conrail Perimeter Drainage Ditch	4	8	6	Surface and Subsurface

Surface soil samples were collected from appropriate locations, as referenced in the FSP, from a depth of 0- to two-inches. Subsurface soil samples were collected from depths of two-inches to 12-inches, and subsequent one-foot interval to the top of clay. The soil samples were analyzed by the laboratory, Recra Environmental, Inc. (Recra), for lead in successive order, beginning at the top of the boring progressing to the top of clay sample. Lead analysis ceased at a boring location when lead concentrations in a sample were determined to be less than 750 parts per million (ppm) or upon reaching the top of clay, as specified in the FSP. The soil samples that were collected, but not analyzed, for this field effort have been archived for potential future reference.

The Conrail perimeter drainage ditch involved the collection of four surface and four subsurface sediment samples define the limits of lead concentration in excess of 750 ppm associated with former drainage ditch sampling points D-7 and D-8.

3.0 ANALYTICAL RESULTS

The soil samples collected during the field investigation were submitted Recra for analysis of lead by USEPA Method 6010 ICP under NYSDEC ASP 10/95 protocol. A total of 543 soil samples and eight sediment samples were submitted to Recra for potential analysis. Based on the iterative process (using the cleanup level of 750 ppm as the cutoff for laboratory analysis) referenced for analyzing soil samples, a total of 203 soil samples and six sediment samples were analyzed. The analytical results are presented in Table 1 of this report.

Duplicate samples and MS/ MSD samples were analyzed at a frequency of 1 in 20, yielding an additional 11 soil samples and 1 sediments, per each sample type. In addition, equipment blanks were collected at a frequency of 1

per day, per sample type (i.e., soil or sediment) for laboratory analysis. The soil boring program was completed in 6 days, yielding 6 equipment blank samples and the sediment sampling was completed in one day with one equipment blank being collected for analysis.

The laboratory results for equipment blank samples are presented in Table 1. All results were non-detect concentrations, except for the sample collected from soil sampling equipment on April 16, 1988 which was reported at 11.6 micrograms per liter or parts per billion.

The laboratory analytical reports generated by the analytical laboratory are currently being reviewed by a data validation chemist. Review of laboratory data packages includes an evaluation of holding times, calibration requirements (initial and continuing), blank contamination, surrogate spikes (where applicable), and matrix spikes and duplicates (where applicable), as referenced in the Bem Metal/Universal Sites QAPP. Validated data and associated validation reports will be forwarded to the NYSDEC upon their completion.

TABLE 1

REMEDIAL INVESTIGATION REPORT
BERN METAL/UNIVERSAL SITES PRP TECHNICAL COMMITTEE
BUFFALO, NEW YORK

LEAD CONCENTRATIONS IN SOIL

Sample Depth Soil Sample ID	(0-2) 10	(2-3) 4	(1-2) 2	(2-3) 3	(3-4) 4	(4-5) 5	(5-6) 6	(6-7) 7	(7-8) 8
Universal Metals									
UM-1	NSC	1,470 N	102	NA	NA	NA	NA	NSC	NSC
UM-2	NSC	11,500 N	7,020 N/6,330	3,870	116	NA	NA	NA	NA
UM-3	NSC	2,110 N	2,200	NSC	NSC	NSC	NSC	NSC	NSC
UM-4	NSC	445 N	NA	NA	NSC	NSC	NSC	NSC	NSC
UM-5	NSC	2,620 N	400 N	NSC	NSC	NSC	NSC	NSC	NSC
UM-6	NSC	162	NA	NA	NSC	NSC	NSC	NSC	NSC
UM-7	NSC	4,730	13,400	17,300	NSC	NSC	NSC	NSC	NSC
UM-8	NSC	5,570	741	NSC	NSC	NSC	NSC	NSC	NSC
UM-9	NSC	2,690	1,080	288	NSC	NSC	NSC	NSC	NSC
UM-10	NSC	10,000 N/5,780 N	6,540	NSC	NSC	NSC	NSC	NSC	NSC
UM-11	NSC	463	NA	NA	NSC	NSC	NSC	NSC	NSC
UM-12	NSC	1,760	3,100	NSC	NSC	NSC	NSC	NSC	NSC
UM-13	NSC	3,090	3,560	NSC	NSC	NSC	NSC	NSC	NSC
UM-14	NSC	298 N	NA	NA	NA	NA	NA	NSC	NSC
UM-15	3,030	3,210	2,300	NSC	NSC	NSC	NSC	NSC	NSC
UM-16	1,990	4,180/3,080	9,890	3,780	NSC	NSC	NSC	NSC	NSC
UM-17	NSC	46,600 N	4,950	3,600	5,900	NSC	NSC	NSC	NSC
UM-18	NSC	1,520/13,200 N	12,400	1,080	NSC	NSC	NSC	NSC	NSC
UM-19	3210 N	497	NSC	NSC	NSC	NSC	NSC	NSC	NSC
UM-20	1,450	1,620	1,060	NSC	NSC	NSC	NSC	NSC	NSC
UM-21	4,860	20,400	142,000	28,500	NSC	NSC	NSC	NSC	NSC
UM-22	NSC	5,570 N	1,700	NSC	NSC	NSC	NSC	NSC	NSC
UM-23	267 N	NA	NA	NSC	NSC	NSC	NSC	NSC	NSC
UM-24	10,600	1,370	169	NSC	NSC	NSC	NSC	NSC	NSC
UM-25	1,960 N	3,290/3,380	191 N	NSC	NSC	NSC	NSC	NSC	NSC
UM-26	601 N	NA	NA	NSC	NSC	NSC	NSC	NSC	NSC
UM-27	10,600	4,300	6,670	NSC	NSC	NSC	NSC	NSC	NSC
UM-28	2,170 N	2,060	7,960 N	23.9	NSC	NSC	NSC	NSC	NSC
UM-29	1,140	3,340	14,400	NSC	NSC	NSC	NSC	NSC	NSC
UM-30	1,640 N	719	NA	NA	NSC	NSC	NSC	NSC	NSC
UM-31	210,000	259,000	60,200	NSC	NSC	NSC	NSC	NSC	NSC
UM-32	20.5 UN	NA	NA	NA	NA	NSC	NSC	NSC	NSC
UM-33	25.9 N	NA	NA	NA	NA	NA	NSC	NSC	NSC
UM-34	38.8 N	NA	NA	NA	NA	NSC	NSC	NSC	NSC

Notes:

See page 4.

TABLE 1

REMEDIAL INVESTIGATION REPORT
BERN METAL/UNIVERSAL SITES PRP TECHNICAL COMMITTEE
BUFFALO, NEW YORK

LEAD CONCENTRATIONS IN SOIL

Sample Depth / Soil Sample I.D.	(0' - 2') 0 - 1	(2' - 12') 1	(1' - 2') 2	(2' - 3') 3	(3' - 4') 4	(4' - 5') 5	(5' - 6') 6	(6' - 7') 7	(7' - 8') 8	(8' - 9') 9
Conrail South										
CS-1	870 N	327 N	NA	NA	NA	NA	NSC	NSC	NSC	NSC
CS-2	NSC	1,960 N	27.9 UN	NA	NA	NA	NA	NSC	NSC	NSC
CS-3	1,680 N	1,610	1,230	1,550	150	NA	NSC	NSC	NSC	NSC
CS-4	NSC	1,850 N	2,070	651	NA	NA	NA	NA	NA	NSC
CS-5	NSC	1,760 N	24.8 UN	NA	NA	NA	NA	NSC	NSC	NSC
CS-6	NSC	35.3 N	NA	NA	NA	NSC	NSC	NSC	NSC	NSC
CS-7	NSC	2,430 N	25.4 UN	NA	NA	NSC	NSC	NSC	NSC	NSC
CS-8	NSC	4,760 N	122 N	NA	NA	NA	NA	NSC	NSC	NSC
CS-9	443 N	NA	NA	NA	NSC	NSC	NSC	NSC	NSC	NSC
CS-10	491 N	NA	NA	NA	NSC	NSC	NSC	NSC	NSC	NSC
CS-11	NSC	626 N	NA	NA	NA	NA	NA	NA	NSC	NSC
CS-12	NSC	4,800 N	11,800	71,300	523	NA	NA	NA	NA	NA
CS-13	NSC	206 N	NA	NA	NA	NSC	NSC	NSC	NSC	NSC
CS-14	NSC	299 N	NA	NA	NSC	NSC	NSC	NSC	NSC	NSC
CS-15	964 N	949	140	NA	NSC	NSC	NSC	NSC	NSC	NSC
CS-16	319 N	NA	NA	NA	NSC	NSC	NSC	NSC	NSC	NSC
CS-17	572 N	NA	NA	NA	NSC	NSC	NSC	NSC	NSC	NSC
CS-18	NSC	672 N/490 N	NA	NSC	NSC	NSC	NSC	NSC	NSC	NSC
CS-19	NSC	188 N	NA	NA	NA	NA	NSC	NSC	NSC	NSC
CS-20	NSC	235 N	NSC	NSC	NSC	NSC	NSC	NSC	NSC	NSC
CS-21	NSC	425 N	NA	NA	NA	NA	NA	NA	NSC	NSC
CS-22	NSC	56,400 N	909	345	NA	NA	NA	NA	NSC	NSC
CS-23	NSC	138 N	NSC	NSC	NSC	NSC	NSC	NSC	NSC	NSC
CS-24	NSC	579 N	NSC	NSC	NSC	NSC	NSC	NSC	NSC	NSC
CS-25	NSC	442 N	NA	NA	NA	NA	NA	NSC	NSC	NSC

Notes:

See page 4.

TABLE 1

REMEDIAL INVESTIGATION REPORT
BERN METAL/UNIVERSAL SITES PRP TECHNICAL COMMITTEE
BUFFALO, NEW YORK

LEAD CONCENTRATIONS IN SOIL

Sample Depth / Soil Sample I.D.	(0' - 2')	(2' - 12')	(1' - 2')	(2' - 3')	(3' - 4')	(4' - 5')	(5' - 6')	(6' - 7')	(7' - 8')	(8' - 9')
Conrail Right-of-Way										
CROW-1	NSC	171 N/273 N	NA	NA	NA	NA	NA	NA	NA	NA
CROW-2	345 N	NA	NA	NA	NA	NSC	NSC	NSC	NSC	NSC
CROW-3	323 N	NA	NA	NA	NSC	NSC	NSC	NSC	NSC	NSC
CROW-4	381 N	NA	NA	NSC	NSC	NSC	NSC	NSC	NSC	NSC
CROW-5	299 N	NA	NA	NA	NA	NA	NSC	NSC	NSC	NSC
CROW-6	1,980 N	1,110	3,580	287	NA	NA	NA	NA	NA	NA
CROW-7	2,040 N/1,750 N	866	326	NSC	NSC	NSC	NSC	NSC	NSC	NSC
CROW-8	22.9 UN	NSC	NSC	NSC	NSC	NSC	NSC	NSC	NSC	NSC
CROW-9	27,900 N	48.1 N	NA	NA	NSC	NSC	NSC	NSC	NSC	NSC
CROW-10	1,020 N	8,760	67.3	NA	NA	NA	NSC	NSC	NSC	NSC
CROW-11	23,500 N	1,220	489	NA	NA	NSC	NSC	NSC	NSC	NSC
CROW-12	NSC	780 N	221	NA	NSC	NSC	NSC	NSC	NSC	NSC
CROW-13	NSC	NSC	NSC	NSC	NSC	NSC	NSC	NSC	NSC	NSC
CROW-14	NSC	4,940 N	57.2	NA	NSC	NSC	NSC	NSC	NSC	NSC
CROW-15	NSC	34.9 N	NA	NA	NSC	NSC	NSC	NSC	NSC	NSC
CROW-16	NSC	62.2 N	NA	NA	NA	NA	NA	NA	NA	NA
CROW-17	NSC	NA	NA	NSC	NSC	NSC	NSC	NSC	NSC	NSC
CROW-18	NA	NA	NA	NA	NSC	NSC	NSC	NSC	NSC	NSC
CROW-19	NA	NA	NA	NA	NA	NA	NA	NSC	NSC	NSC
CROW-20	NA	NA	NA	NA	NA	NA	NA	NA	NSC	NSC
CROW-21	846 N	1,260	743	NA	NA	NA	NA	NSC	NSC	NSC
CROW-22	1,040 N	269	NA	NA	NA	NA	NA	NSC	NSC	NSC
CROW-23	357 N	NA	NA	NA	NA	NA	NA	NSC	NSC	NSC
CROW-24	1,280 N	262 N	NA	NA	NA	NA	NSC	NSC	NSC	NSC
CROW-25	298 N	NA	NA	NA	NA	NA	NA	NA	NSC	NSC
CROW-26	4,740 N	802	321	NA	NA	NSC	NSC	NSC	NSC	NSC
CROW-27	NSC	561 N	NA	NA	NA	NSC	NSC	NSC	NSC	NSC
CROW-28	NSC	1,130 N/703 N	23.6 UN	NA	NSC	NSC	NSC	NSC	NSC	NSC
CROW-29	453 N	NA	NA	NA	NSC	NSC	NSC	NSC	NSC	NSC
CROW-30	NA	NA	NA	NA	NSC	NSC	NSC	NSC	NSC	NSC
CROW-31	NA	NA	NA	NA	NA	NSC	NSC	NSC	NSC	NSC
CROW-32	NA	NA	NA	NA	NA	NSC	NSC	NSC	NSC	NSC
CROW-33	NA	NA	NA	NA	NA	NA	NSC	NSC	NSC	NSC
CROW-34	345 N	NA	NA	NA	NA	NA	NA	NA	NA	NSC
CROW-35	646 N	NA	NA	NA	NA	NA	NA	NA	NA	NA
CROW-36	NA	NA	NA	NA	NA	NA	NA	NA	NA	NSC
CROW-37	371 N	NA	NA	NA	NA	NA	NA	NA	NA	NA
CROW-38	NA	NA	NA	NA	NA	NSC	NSC	NSC	NSC	NSC
CROW-39	715 N	185	NA	NA	NA	NA	NA	NSC	NSC	NSC
CROW-40	NSC	232 N	NA	NA	NA	NSC	NSC	NSC	NSC	NSC
CROW-41	NSC	2,260 N	427	NA	NSC	NSC	NSC	NSC	NSC	NSC
CROW-42	NSC	223 N	NA	NA	NSC	NSC	NSC	NSC	NSC	NSC
CROW-43	NSC	88.5 N	NA	NA	NSC	NSC	NSC	NSC	NSC	NSC

Notes:

See page 4.

TABLE 1

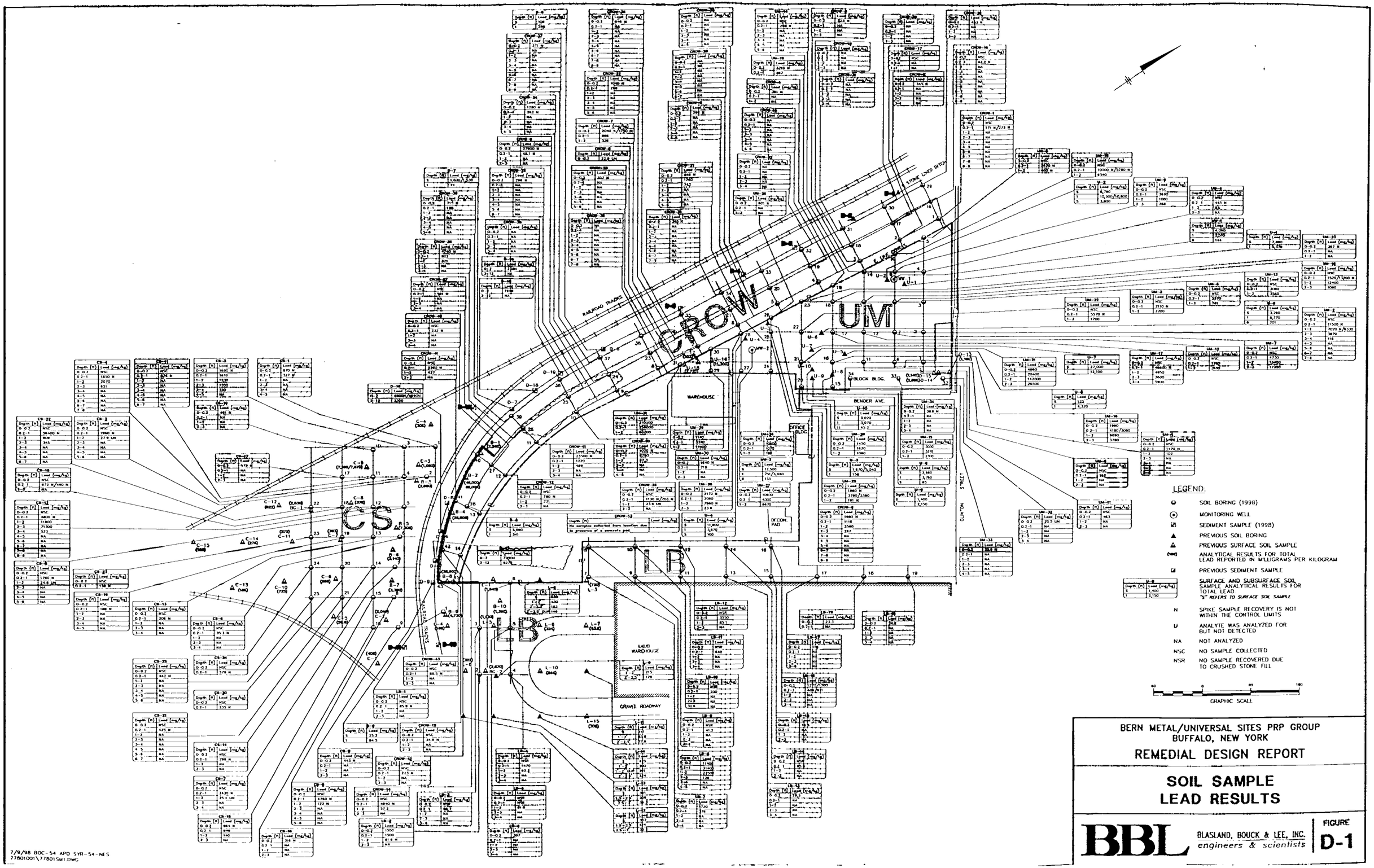
REMEDIAL INVESTIGATION REPORT
BERN METAL/UNIVERSAL SITES PRP TECHNICAL COMMITTEE
BUFFALO, NEW YORK

LEAD CONCENTRATIONS IN SOIL

Sample Depth / Soil Sample I.D.	(0'-2') SO-1	(2'-12') SO-2	(0'-2') SO-3	(2'-8') SO-4	(0'-2') SO-5	(2'-6') SO-6
Laub Property						
LB-1	NSC	85.9 N	NA	NA	NSC	NSC
LB-2	1,550	1,500	61.6 N	NA	NSC	NSC
LB-3	NSR	66.7	NA	NA	NA	NSC
LB-4	NSR	1,470	62.2	NA	NA	NSC
LB-5	NSR	NSR	81.8	NA	NA	NSC
LB-6	307	NA	NA	NA	NA	NSC
LB-7	1,720	376	NA	NA	NA	NSC
LB-8	11,400	31,400	22,500	128	NA	NA
LB-9	NSR	41.2	NA	NA	NA	NSC
LB-10	NSR	250	NA	NA	NA	NSC
LB-11	NSR	640	NA	NA	NA	NSC
LB-12	NSR	3,550	85.1	NA	NSC	NSC
LB-13	29.3	NA	NA	NA	NA	NSC
LB-14	NSR	65.6	NA	NA	NSC	NSC
LB-15	16.5	NA	NA	NA	NSC	NSC
LB-16	1,270/1,380	486/611	NA	NA	NA	NSC
LB-17	116	NA	NA	NA	NA	NSC
LB-18	24.8	NA	NA	NA	NA	NSC
LB-19	23.3	NA	NSC	NSC	NSC	NSC
Conrail Ditch						
D-16	4,900 N/4,690 N	3,300	NSC	NSC	NSC	NSC
D-17	7,230 N	9,270	NSC	NSC	NSC	NSC
D-18	194 N	NA	NSC	NSC	NSC	NSC
D-19	238 N	NA	NSC	NSC	NSC	NSC

Notes:

All concentrations are 1995 NYS ASP data quality, and are reported in milligrams per kilogram (mg/kg) or parts per million (ppm).
Equipment blank results are non-detect for samples collected on April 9,10,14, 15, and 16 (sediment). The equipment blank sample collected from soil sampling equipment on April 16, 1998 was reported at 11.6 micrograms per liter (ug/L) or parts per billion (ppb).
N : Spike sample recovery not within control limits.
NA : Sample not analyzed.
NSC : No sample collected
NSR : No sample recovered due to crushed stone fill.


CROW
UM
CS
B
RAILROAD TRACKS
WAREHOUSE
OFFICE BLDG.
BLOCK BLDG.
BENDER AVE.
LAUB WAREHOUSE
GRAVEL ROADWAY
STONE LINED DITCH
CULVERT
STREET
DECON. PAD
LEGEND:
SOIL BORING (1998)
MONITORING WELL
SEDIMENT SAMPLE (1998)
PREVIOUS SOIL BORING
PREVIOUS SURFACE SOIL SAMPLE
(1000) ANALYTICAL RESULTS FOR TOTAL LEAD REPORTED IN MILLIGRAMS PER KILOGRAM
PREVIOUS SEDIMENT SAMPLE
SURFACE AND SUBSURFACE SOIL SAMPLE ANALYTICAL RESULTS FOR TOTAL LEAD
"S" REFERS TO SURFACE SOIL SAMPLE
N SPIKE SAMPLE RECOVERY IS NOT WITHIN THE CONTROL LIMITS
U ANALYTE WAS ANALYZED FOR BUT NOT DETECTED
NA NOT ANALYZED
NSC NO SAMPLE COLLECTED
NSR NO SAMPLE RECOVERED DUE TO CRUSHED STONE FILL
GRAPHIC SCALE
BERN METAL/UNIVERSAL SITES PRP GROUP
BUFFALO, NEW YORK
REMEDIAL DESIGN REPORT
SOIL SAMPLE
LEAD RESULTS
BBL BLASLAND, BOUCK & LEE, INC. engineers & scientists
FIGURE D-1
7/9/98 BOC-54 APD SYR-54-NES
778010001\778015M1.DWG

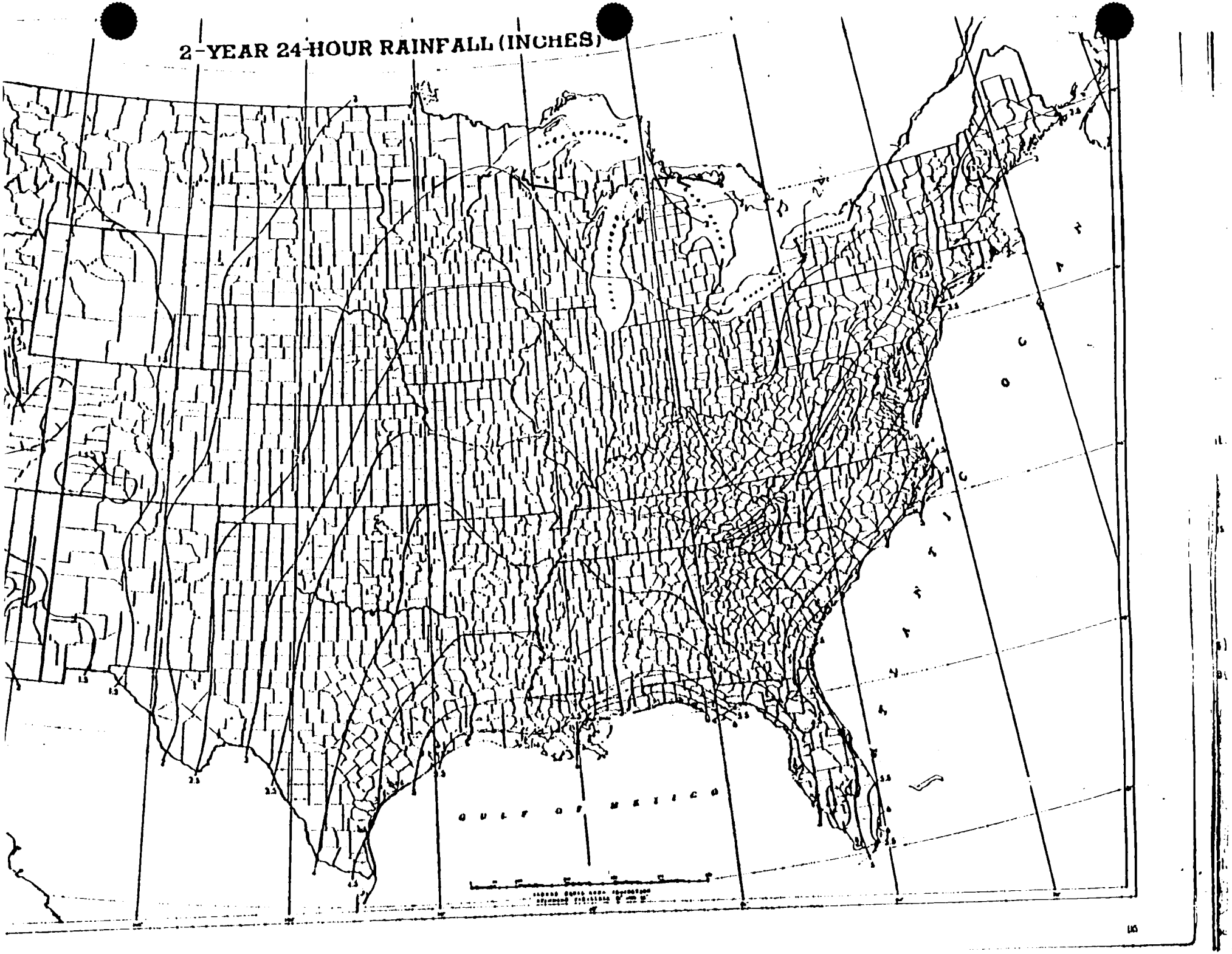
Appendix E

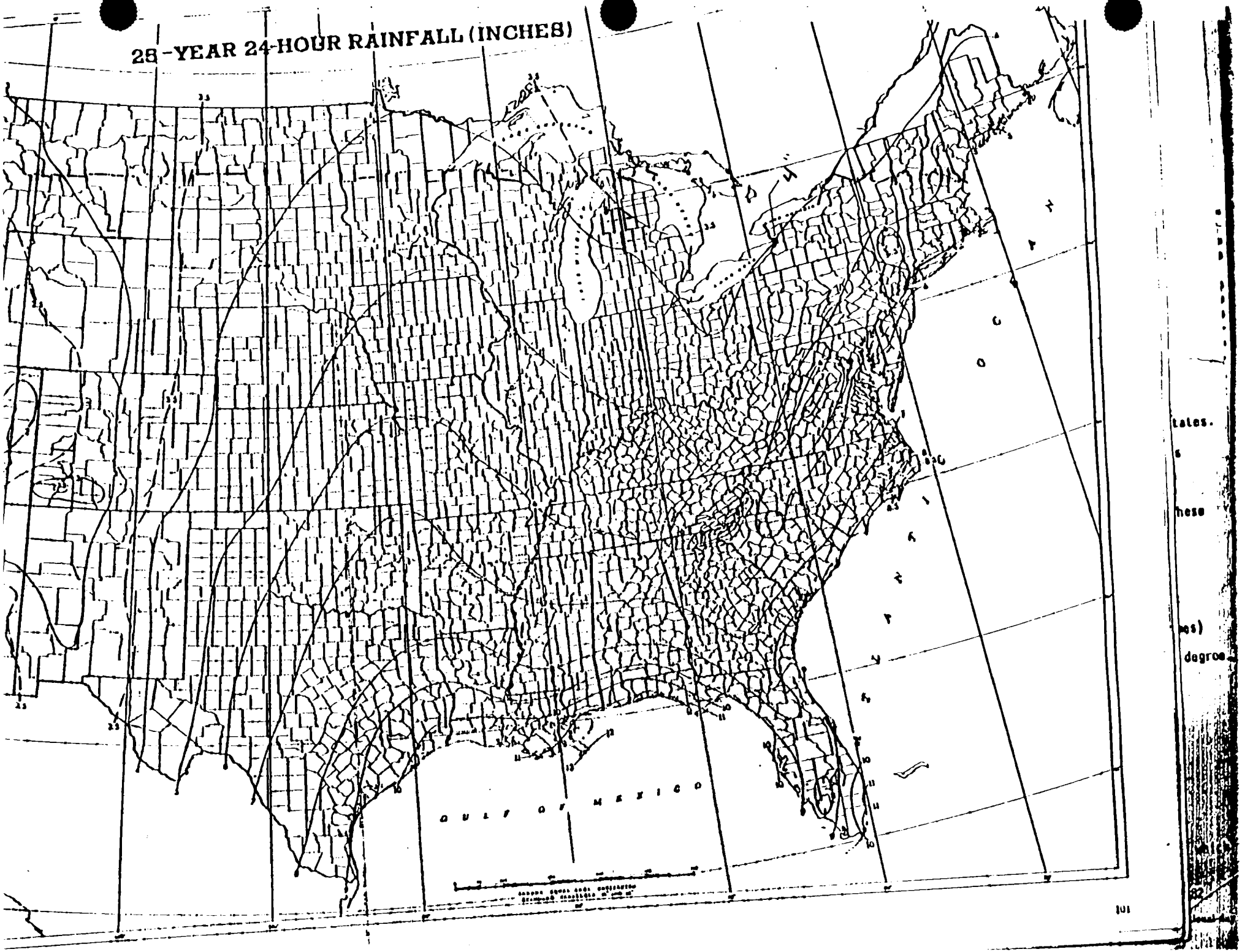
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

Appendix E

Stormwater Data

Precipitation Maps


2-YEAR 24-HOUR RAINFALL (INCHES)
GULF OF MEXICO

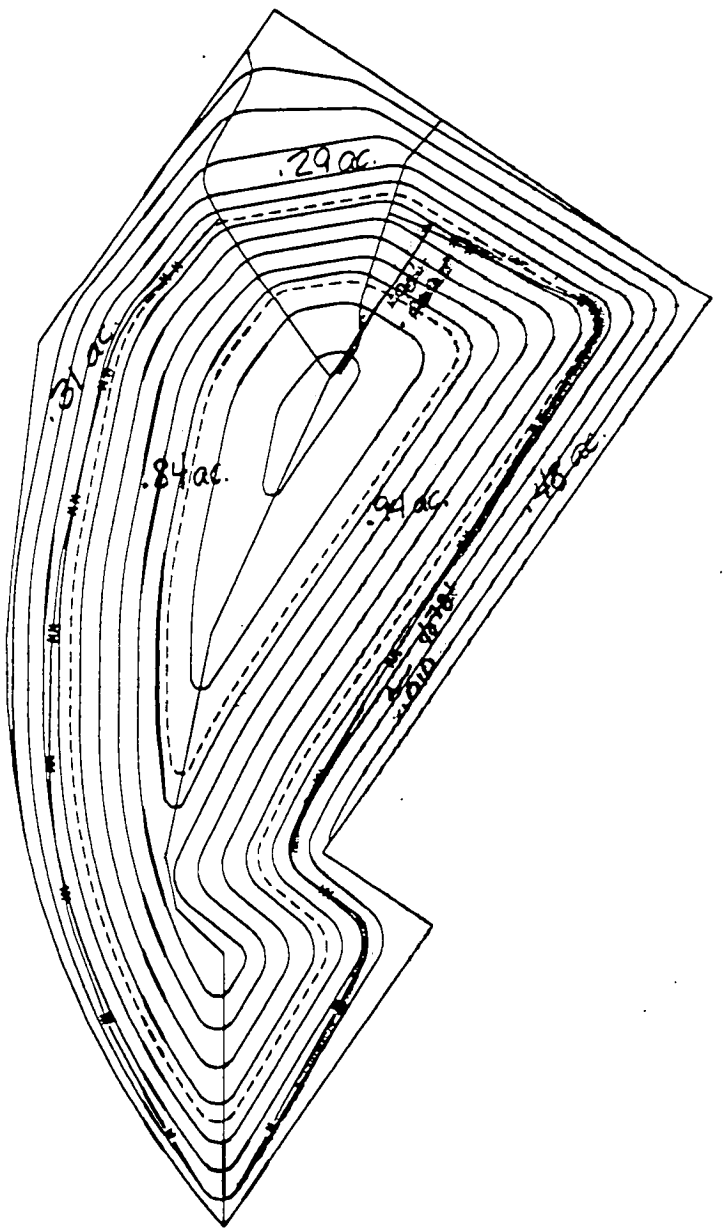

25-YEAR 24-HOUR RAINFALL (INCHES)
GULF OF MEXICO

Mid-Slope Drainage Swale

Watershed Boundary

Kern Metal Site
Watershed Area
Scale 1" = 100'

N



✓ use .94 acres - largest area for midslope swales

✓ use 1.78 acres for off-site drainage

Calculations

Newly Graded

RUNOFF CURVE NUMBER COMPUTATION Version 2.00

Project : Bern Metal User: CEB Date: 06-22-98
County : Erie State: NY Checked: ____ Date: _____
Subtitle: Midslope Swale - Newly Graded Condition

COVER DESCRIPTION	Hydrologic Soil Group A	B	C	D
	Acres (CN)			
DEVELOPING URBAN AREA (No Vegetation)				
ewly graded area (pervious only)	-	-	.94 (91)	-
otal Area (by Hydrologic Soil Group)			.94	
			====	

TOTAL DRAINAGE AREA: .94 Acres WEIGHTED CURVE NUMBER: 91*

- Generated for use by GRAPHIC method

TIME OF CONCENTRATION AND TRAVEL TIME Version 2.00

Project : Bern Metal User: CEB Date: 06-22-98
County : Erie State: NY Checked: ____ Date: _____
Subtitle: Midslope Swale - Newly Graded Condition

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	2.4	90	.060	b					0.046
Open Channel		678	.010		.041	2.43	5.69		0.091
						Time of Concentration =			0.14*

--- Sheet Flow Surface Codes ---

A Smooth Surface
B Fallow (No Res.)
C Cultivated < 20 % Res.
D Cultivated > 20 % Res.
E Grass-Range, Short
F Grass, Dense
G Grass, Burmuda
H Woods, Light
I Woods, Dense
J Range, Natural

--- Shallow Concentrated Surface Codes ---

P Paved
U Unpaved

* - Generated for use by GRAPHIC method

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : Bern Metal User: CEB Date: 06-22-98
County : Erie State: NY Checked: ____ Date: _____
Subtitle: Midslope Swale - Newly Graded Condition

Data: Drainage Area : .94 * Acres
Runoff Curve Number : 91 *
Time of Concentration: 0.14 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	4
Ia/P Ratio	0.05
Used	0.10
Runoff (in)	3.02
Unit Peak Discharge (cfs/acre/in)	1.421
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	4

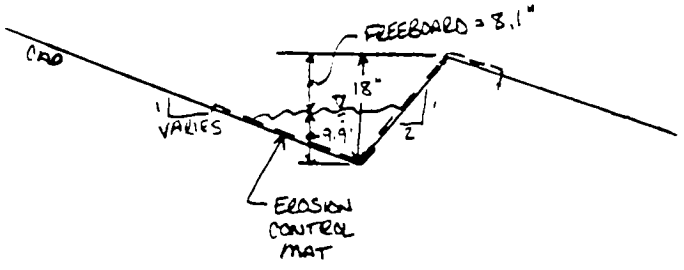
* - Value(s) provided from TR-55 system routines

BERN METAL/UNIVERSAL SITE

Midslope Swale Design - Newly Graded Condition

1. Design capacity required = 4 cfs (see TR55 printout for 25yr/24hr storm event).

2. Midslope Swale Configuration:



3. Design Conditions:

DESIGN PARAMETERS	DESIGN	MAXIMUM
BASE WIDTH (FT):	0.00	0.00
CHANNEL DEPTH (IN):	18.00	18.00
DEPTH OF FLOW (IN):	9.90	15.00
AVG. SIDE SLOPE GRADIENT (FT):	3.00	3.00
AVG. SIDE SLOPE LENGTH (FT):	2.61	3.95
MANNING VALUE, n:	0.041	0.041
CHANNEL SLOPE, S (FT/FT):	0.010	0.010

DESIGN SPECIFICATIONS	DESIGN	MAXIMUM
AREA, A (SF):	2.04	4.69
WETTED PERIMETER, WP (FT):	5.22	7.91
HYDRAULIC RADIUS, R (FT):	0.39	0.59

DESIGN PERFORMANCE	DESIGN	MAXIMUM
DISCHARGE, Q (CFS): Q= A(1.49/n)R^0.67 S	4.0	12.0
VELOCITY, V (FPS): V=Q/A	1.9	2.6
FREE BOARD (IN)	8.1	3.0

4. Erosion Control:

A temporary erosion control mat, North American Green SC150, to be used to line the midslope swale.

****

NORTH AMERICAN GREEN CHANNEL PROTECTION
USER SPECIFIED CHANNEL LINING ANALYSIS

****

PROJECT NAME: Bern Metal
:OMPUTED BY: CEB
'ROM STATION/REACH:
DRAINAGE AREA: .94 Acres

PROJECT NO.: 77801
DATE: 06-22-1998
TO STATION/REACH:
DESIGN FREQUENCY: 25 Yr. Storm

Channel Bottom Width (ft)	Side Slope Lt. (Horz. to 1)	Side Slope Rt. (Horz. to 1)	Channel Slope (ft/ft)
0.00	4.0	2.0	0.010

Discharge (cfs)	Peak Flow Period (hrs)	Velocity (ft/sec)	Area (sf)	Hydraulic Radius (ft)	Normal Depth (ft)
4.0	12.0	1.88	2.13	0.40	0.84

Lining Type	Manning Coefficient	Permissible Shear (lb/sf)	Calculated Shear (lb/sf)	Safety Factor	Remark
:C150 Staple D	0.043	1.80	0.53	3.43	STABLE

Calculations
Fully Vegetated

RUNOFF CURVE NUMBER COMPUTATION Version 2.00

Project : Bern Metal User: CEB Date: 06-22-98
County : Erie State: NY Checked: ____ Date: _____
Subtitle: Midslope Swale - Newly Graded Condition

COVER DESCRIPTION	Hydrologic Soil Group A	B	C	D
	Acres (CN)			
FULLY DEVELOPED URBAN AREAS (Veg Estab.)				
Open space (Lawns,parks etc.)				
Good condition; grass cover > 75%	-	-	.94 (74)	-
Total Area (by Hydrologic Soil Group)			.94	
			====	

TOTAL DRAINAGE AREA: .94 Acres WEIGHTED CURVE NUMBER: 74*

- Generated for use by GRAPHIC method

TIME OF CONCENTRATION AND TRAVEL TIME Version 2.00

Project : Bern Metal User: CEB Date: 06-22-98
County : Erie State: NY Checked: _____ Date: _____
Subtitle: Midslope Swale - Newly Graded Condition

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	2.4	90	.060	e					0.112
Open Channel		678	.010		.041	2.43	5.69		0.091
						Time of Concentration =			0.20*
									=====

--- Sheet Flow Surface Codes ---

A Smooth Surface	F Grass, Dense	--- Shallow Concentrated ---
B Fallow (No Res.)	G Grass, Burmuda	--- Surface Codes ---
C Cultivated < 20 % Res.	H Woods, Light	P Paved
D Cultivated > 20 % Res.	I Woods, Dense	U Unpaved
E Grass-Range, Short	J Range, Natural	

* - Generated for use by GRAPHIC method

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : Bern Metal User: CEB Date: 06-22-98
County : Er[illegible] State: NY Checked: ____ Date: _____
Subtitle: Mi[illegible] ope Swale - Newly Graded Condition

Data: Drainage Area : .94 * Acres
Runoff Curve Number : 74 *
Time of Concentration: 0.20 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	4
Ia/P Ratio	0.18
Runoff (in)	1.60
Unit Peak Discharge (cfs/acre/in)	1.189
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	2

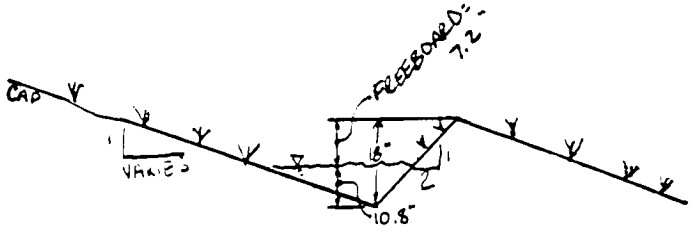
* - Value(s) provided from TR-55 system routines

BERN METAL/UNIVERSAL SITE

Midslope Swale Design - Vegetated Condition

1. Design capacity required = 2 cfs (see TR55 printout for 25yr/24hr storm event).

2. Midslope Swale Configuration:



3. Design Conditions:

DESIGN PARAMETERS	DESIGN	MAXIMUM
BASE WIDTH (FT):	0.00	0.00
CHANNEL DEPTH (IN):	18.00	18.00
DEPTH OF FLOW (IN):	10.80	15.00
AVG. SIDE SLOPE GRADIENT (FT):	3.00	3.00
AVG. SIDE SLOPE LENGTH (FT):	2.85	3.95
MANNING VALUE, n:	0.100	0.100
CHANNEL SLOPE, S (FT/FT):	0.010	0.010

DESIGN SPECIFICATIONS	DESIGN	MAXIMUM
AREA, A (SF):	2.43	4.69
WETTED PERIMETER, WP (FT):	5.69	7.91
HYDRAULIC RADIUS, R (FT):	0.43	0.59

DESIGN PERFORMANCE	DESIGN	MAXIMUM
DISCHARGE, Q (CFS): Q= A(1.49/n)R^0.67 S	2.0	4.9
VELOCITY, V (FPS): V=Q/A	0.8	1.0
FREE BOARD (IN)	7.2	3.0

4. Erosion Control:

A vegetated condition is stable.

****

NORTH AMERICAN GREEN CHANNEL PROTECTION
USER SPECIFIED CHANNEL LINING ANALYSIS

****

PROJECT NAME: Bern Metal
OMPUTED BY: CEB
ROM STATION/REACH:
DRAINAGE AREA: .94 Acres

PROJECT NO.: 77801
DATE: 06-22-1998
TO STATION/REACH:
DESIGN FREQUENCY: 25 Yr. Storm

Channel Bottom Width (ft)	Side Slope Lt. (Horz. to 1)	Side Slope Rt. (Horz. to 1)	Channel Slope (ft/ft)
0.00	4.0	2.0	0.010

Discharge (cfs)	Peak Flow Period (hrs)	Velocity (ft/sec)	Area (sf)	Hydraulic Radius (ft)	Normal Depth (ft)
2.0	12.0	0.83	2.40	0.42	0.89

Lining Type	Manning Coefficient	Permissible Shear (lb/sf)	Calculated Shear (lb/sf)	Safety Factor	Remark
eget.	0.100	Veg.	3.33	0.56	5.97	STABLE
		Loam	0.035	0.007	5.17	STABLE

Class D Vegetation

Perimeter Drainage Ditch

Calculations

Newly Graded

RUNOFF CURVE NUMBER COMPUTATION Version 2.00

Project : Bern Metal User: CEB Date: 06-22-98
County : Erie State: NY Checked: ____ Date: _____
Subtitle: Perimeter Drainage Ditch-Newly Graded Condition
Subarea : p-dtch

COVER DESCRIPTION	Hydrologic Soil Group A	B	C	D
	Acres (CN)			
DEVELOPING URBAN AREA (No Vegetation)				
Newly graded area (pervious only)	-	-	0.37(91)	-
Total Area (by Hydrologic Soil Group)			.37	
			====	

SUBAREA: p-dtch TOTAL DRAINAGE AREA: .37 Acres WEIGHTED CURVE NUMBER: 91*

* - Generated for use by GRAPHIC method

TIME OF CONCENTRATION AND TRAVEL TIME Version 2.00

Project : Bern Metal User: CEB Date: 06-22-98
County : Erie State: NY Checked: ____ Date: _____
Subtitle: Perimeter Drainag Ditch-Newly Graded Condition

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	2.4	13	.25	b					0.006
Open Channel		570	.005		.04	4.82	8.94		0.091
								Time of Concentration =	0.10*
									=====

--- Sheet Flow Surface Codes ---

A Smooth Surface	F Grass, Dense	--- Shallow Concentrated ---
B Fallow (No Res.)	G Grass, Burmuda	--- Surface Codes ---
C Cultivated < 20 % Res.	H Woods, Light	P Paved
D Cultivated > 20 % Res.	I Woods, Dense	U Unpaved
E Grass-Range, Short	J Range, Natural	

- Generated for use by GRAPHIC method

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : Bern Metal User: CEB Date: 06-22-98
County : Erie State: NY Checked: ____ Date: _____
Subtitle: Perimeter Drainage Ditch-Newly Graded Condition

Data: Drainage Area : .37 * Acres
Runoff Curve Number : 91 *
Time of Concentration: 0.10 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	4
Ia/P Ratio	0.05
Used	0.10
Runoff (in)	3.02
Unit Peak Discharge (cfs/acre/in)	1.578
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	2

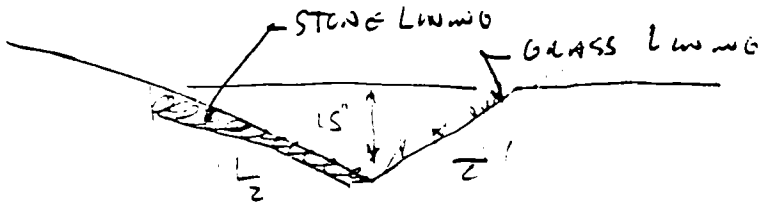
* - Value(s) provided from TR-55 system routines

BERN METAL/UNIVERSAL SITE

Perimeter Drainage Ditch Design - Vegetated Condition

1. Design capacity required = 2 cfs (see TR55 printout for 25yr/24hr storm event).

2. Ditch Configuration:



3. Design Conditions:

DESIGN PARAMETERS	DESIGN	MAXIMUM
BASE WIDTH (FT):	0.00	0.00
CHANNEL DEPTH (IN):	15.00	15.00
DEPTH OF FLOW (IN):	11.20	12.00
AVG. SIDE SLOPE GRADIENT (FT):	2.00	2.00
AVG. SIDE SLOPE LENGTH (FT):	2.09	2.24
MANNING VALUE, n:	0.050	0.050
CHANNEL SLOPE, S (FT/FT):	0.005	0.005

DESIGN SPECIFICATIONS	DESIGN	MAXIMUM
AREA, A (SF):	1.74	2.00
WETTED PERIMETER, WP (FT):	4.17	4.47
HYDRAULIC RADIUS, R (FT):	0.42	0.45

DESIGN PERFORMANCE	DESIGN	MAXIMUM
DISCHARGE, Q (CFS): Q= A(1.49/n)R^0.67 S^	2.0	2.5
VELOCITY, V (FPS): V=Q/A	1.2	1.2
FREE BOARD (IN)	3.8	3.0

4. Erosion Control:

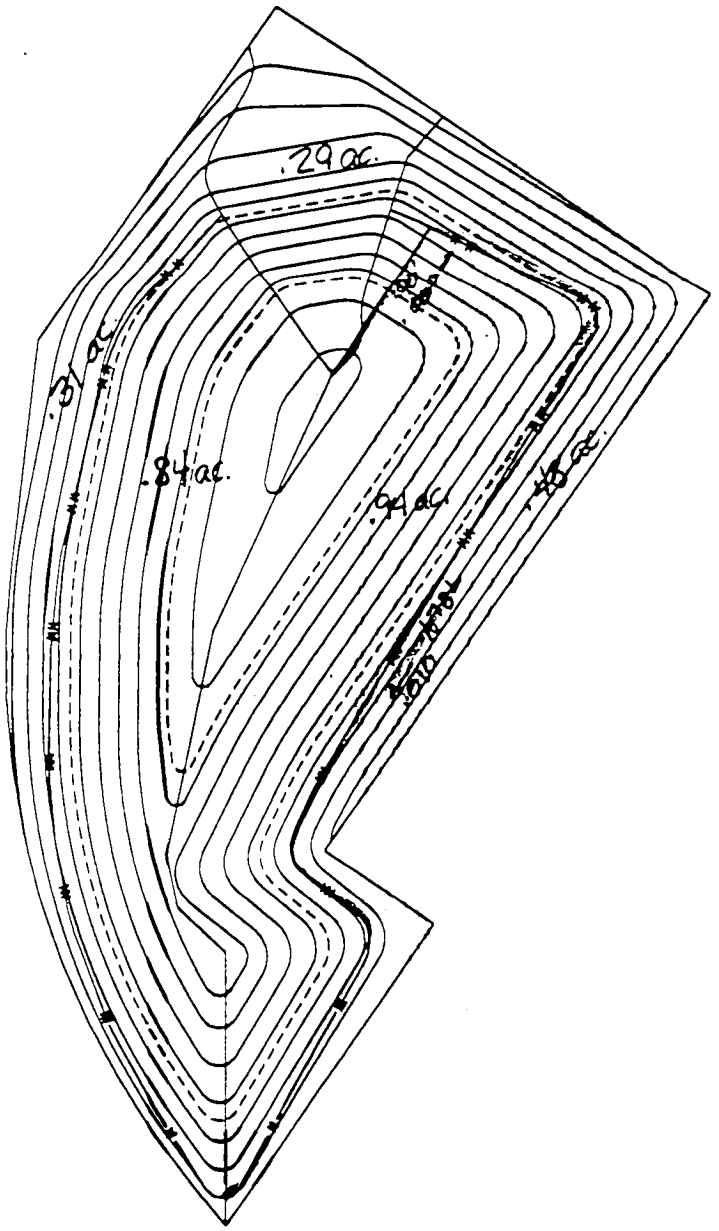
Ditch interior to lined will stone and vegetation.

Outlet Drainage Ditch

Watershed Boundary

:-n Metal Site
Watershed Area
Scale 1" = 100'

N



✓ use .94 acres - largest aua for midslope swales

✓ use 1.78 acres for off-site drainage

Calculations

RUNOFF CURVE NUMBER COMPUTATION Version 2.00

Project : Bern Metal User: CEB Date: 06-22-98
County : Erie State: NY Checked: ____ Date: _____
Subtitle: OUTLET DRAINAGE DITCH - Newly Graded Condition

COVER DESCRIPTION	Hydrologic Soil Group A	B	C	D
		Acres (CN)		
DEVELOPING URBAN AREA (No Vegetation)				
Newly graded area (pervious only)	-	-	1.78 (91)	-
Total Area (by Hydrologic Soil Group)			1.78	
			====	

TOTAL DRAINAGE AREA: 1.78 Acres WEIGHTED CURVE NUMBER: 91*

- Generated for use by GRAPHIC method

TIME OF CONCENTRATION AND TRAVEL TIME Version 2.00

Project : Bern Metal
County : Erie State: NY User: CEB Date: 06-22-98
Subtitle: OUTLET DRAINAGE DITCH - Newly Graded Condition Checked: ____ Date: _____

Flow Type	2 year rain	Length (ft)	Slope (ft/ft)	Surface code	n	Area (sq/ft)	Wp (ft)	Velocity (ft/sec)	Time (hr)
Sheet	2.4	90	.060	b					0.046
Open Channel		678	.010		.041	4.82	8.94		0.078
								Time of Concentration =	0.12*
									=====

--- Sheet Flow Surface Codes ---

A Smooth Surface	F Grass, Dense	--- Shallow Concentrated ---
B Fallow (No Res.)	G Grass, Burmuda	--- Surface Codes ---
C Cultivated < 20 % Res.	H Woods, Light	P Paved
D Cultivated > 20 % Res.	I Woods, Dense	U Unpaved
E Grass-Range, Short	J Range, Natural	

- Generated for use by GRAPHIC method

GRAPHICAL PEAK DISCHARGE METHOD Version 2.00

Project : Bern Metal User: CEB Date: 06-22-98
County : Erie State: NY Checked: ____ Date: _____
Subtitle: Outlet Drainage Ditch - Newly Graded Condition

Data: Drainage Area : 1.78 * Acres
Runoff Curve Number : 91 *
Time of Concentration: 0.12 * Hours
Rainfall Type : II
Pond and Swamp Area : NONE

Storm Number	1
Frequency (yrs)	25
24-Hr Rainfall (in)	4
Ia/P Ratio	0.05
Used	0.10
Runoff (in)	3.02
Unit Peak Discharge (cfs/acre/in)	1.494
Pond and Swamp Factor 0.0% Ponds Used	1.00
Peak Discharge (cfs)	8

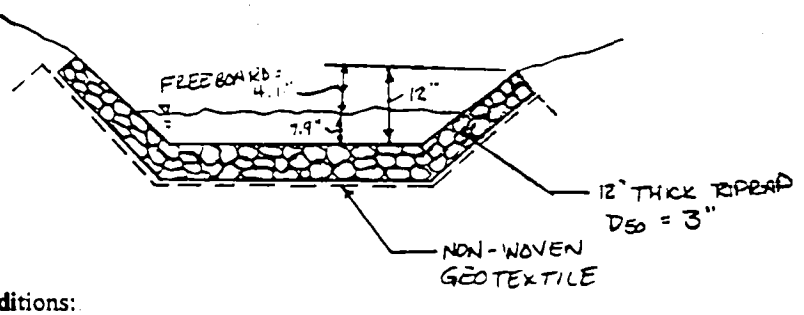
* - Value(s) provided from TR-55 system routines

BERN METAL/UNIVERSAL SITE

OUTLET DITCH newly graded condition

1. Design capacity required = 8 cfs (see TR55 printout for 25yr/24hr storm event).

2. Ditch Configuration:



3. Design Conditions:

DESIGN PARAMETERS	DESIGN	MAXIMUM
BASE WIDTH (FT):	6.00	6.00
CHANNEL DEPTH (IN):	12.00	12.00
DEPTH OF FLOW (IN):	7.90	9.00
AVG. SIDE SLOPE GRADIENT (FT):	2.00	2.00
AVG. SIDE SLOPE LENGTH (FT):	1.47	1.68
MANNING VALUE, n: (Riprap d50=3")	0.059	0.059
CHANNEL SLOPE, S (FT/FT):	0.010	0.010

DESIGN SPECIFICATIONS	DESIGN	MAXIMUM
AREA, A (SF):	4.82	5.63
WETTED PERIMETER, WP (FT):	8.94	9.35
HYDRAULIC RADIUS, R (FT):	0.54	0.60

DESIGN PERFORMANCE	DESIGN	MAXIMUM
DISCHARGE, Q (CFS): Q= A(1.49/n)R^0.67 S	8.0	10.1
VELOCITY, V (FPS): V=Q/A	1.7	1.8
FREE BOARD (IN)	4.1	3.0

4. Erosion Control:

Channel shall be constructed of riprap having a d50=3" and shall be underlain by geotextile.

****

NORTH AMERICAN GREEN CHANNEL PROTECTION
USER SPECIFIED CHANNEL LINING ANALYSIS

****

PROJECT NAME: Bern Metal
COMPUTED BY: CEB
FROM STATION/REACH:
DRAINAGE AREA: 1.78 Acres

PROJECT NO.: 77801
DATE: 06-22-1998
TO STATION/REACH:
DESIGN FREQUENCY: 25 Yr. Storm

Channel Bottom Width (ft)	Side Slope Lt. (Horz. to 1)	Side Slope Rt. (Horz. to 1)	Channel Slope (ft/ft)
6.00	2.0	2.0	0.010

Discharge (cfs)	Peak Flow Period (hrs)	Velocity (ft/sec)	Area (sf)	Hydraulic Radius (ft)	Normal Depth (ft)
8.0	12.0	1.66	4.81	0.54	0.66

Lining Type	Manning Coefficient	Permissible Shear (lb/sf)	Calculated Shear (lb/sf)	Safety Factor	Remark
Riprap 3"	0.059	1.00	0.41	2.44	STABLE